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AN EPITOME

OF

UNIVERSAL KNOWLEDGE

IN THREE VOLUMES

EDITED BY

WILLIAM HENRY CHANDLER, PH.D., F.C.S.

OF THE LEHIGH UNIVERSITY

WITH CONTRIBUTIONS FROM A LARGE NUMBER OF EMINENT SCIENTISTS

ILLUSTRATED BY COLORED MAPS AND ENGRAVINGS

VOLUME ONE

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PETER FENELON COLLIER

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PREFACE

THIS is the age of books of reference, and with reason. There are innumerable subjects which every one wants to know something about, and as to which very few indeed have the occasion, or the opportunity, or the leisure, to gain exhaustive or even especial information. To meet these varied requirements, an encyclopedia must aim to be a compendium of all human knowledge—a summary or abridgment, however brief, of all topics which have interest and value, whether theoretical or practical.

Of course this end has never been perfectly attained, and in the nature of things never can be. Yet every new encyclopedia may and ought to be in some respects an improvement on its predecessors. No branch of knowledge is of full and finished growth: new names, new facts, one might even add, newly discovered principles, are continually coming to the front. A book which would really cover the ground must note in detail the steps of this advance, and in general must reflect the progress of opinion and the change in objects of greatest or less interest. Burning questions of a generation back are now mere matters of history, while problems lately unthought of press us closely, and sciences and devices unknown to our fathers enter into the daily life of civilized nations. The encyclopedia of twenty or even ten years ago is already in part moribund: the value of much of its contents remains unaltered, but its statements here and there seem antiquated, and it inevitably fails to tell us many things that we need to know. Till printing becomes instantaneous, no book can be literally "up to date"; but, other things being equal, the latest work of reference is the best.

It was once the tendency of encyclopedias to expand into whole libraries. They required a shelf or two, of extra length and strength, if not a separate bookcase, for their housing: the ponderous volumes came out in such long succession (though printers worked double tides) that the first was wellnigh obsolete when the last appeared. The cost was beyond plain people—a small fortune to the average farmer or mechanic, and fitted only to deep purses: the contents in the main was adapted to leisurely scholars. The time for this sort of thing is past. In America intelligence and education are not restricted to one favored

class, and books for the diffusion of general information should be moderate in size and cost.

The present work has been built on these lines. It is complete in three volumes of goodly though manageable (not elephantine) size. It is offered at a price hitherto unheard-of for a book of this character. It was brought down to the date of going to press. It was prepared with due regard to the present conditions of thought and progress, giving especial attention to the sciences. And it has been written and edited with a view to the reader's convenience, that (as far as possible) he might find what he wants without having to institute a long and wearisome search, or wade through a chapter when he desires a paragraph.

A work of such moderate size, as compared with nearly all its predecessors, is necessarily characterized by condensation—by the brevity of its articles. It was thought best to include as many titles or topics as possible, and to say what was necessary upon each, omitting unimportant details. If this object has been measurably attained, it is largely through the stress throughout laid upon *itemizing*. There is one article, and usually of some length, on each general subject; but the separate parts of that subject, so far as may be, are separately handled. *E.g.*, if the reader wants a given minor English or Italian poet, he need not look for him under the heading English or Italian Literature, but under his own name.

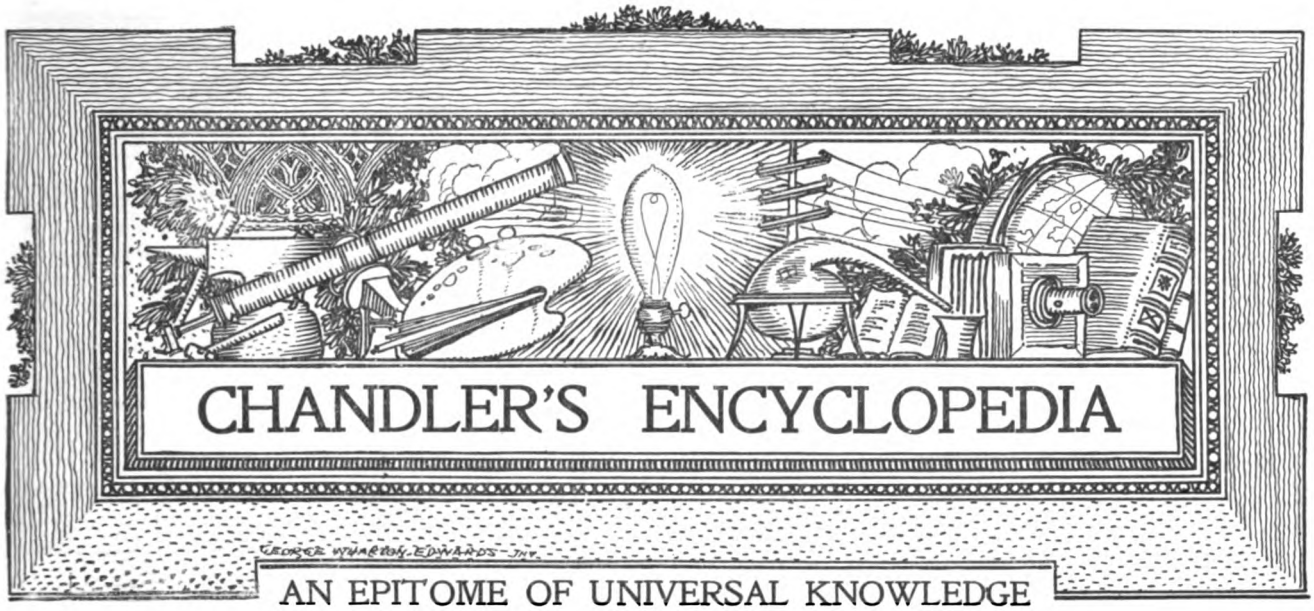
The value of this method, in diminishing long articles and multiplying short ones, will be readily appreciated. The *Britannica* is famous for learned and authoritative treatises, not a few of them long enough to make a goodly volume each: sandwiched between, there was a comparatively small number (from the modern and American viewpoint) of brief or moderate-sized notices of men and things. The *Metropolitana*, earlier yet, was made up of treatises which could be purchased separately, some of them in several volumes: it was not a book of reference, but a series of books for continuous reading. We are far past that fashion now; an encyclopedia with us has to be a book of reference, averaging a good many titles to the page, and including a multitude of topics which were not dreamed of even by the *Britannica*.

Not that it is possible to get rid entirely of long articles. The Roman Empire, and the Steam-Engine, and South America, can neither be disregarded nor covered by a paragraph. Yet it is not therefore necessary to say under these heads all that is known about the subjects. The various countries of South America is entitled each to its own article, and cross-references will avert needless repetitions. If I have occasion to look up certain parts or appurtenances of the steam-engine, I may prefer to find them under their own heads; or if I want the battle of Cannæ, I do not desire to grope through pages of Roman history before I come to it. So, under Georgia, it is necessary only to mention (if so much) the principal cities; these are described under the titles Atlanta, Savannah, and so on.

If many of the scientific articles in this work occupy more space than is usually given to other departments, it is to be remembered that much of this matter is new, and that all of it has been handled by experts, whose duty it was to present the last results of investigation in their several fields. Geography, history, literature, the arts, and "the humanities" have not been neglected; *e.g.*, in biography (American especially), perhaps a

greater number of names is introduced than in any other work of the kind. But the face of things does not alter so rapidly: a war may cause slight changes of coloring on the map, and each decade brings forth new authors and public men, without quite effacing those who went before; whereas some of the "exact" sciences are developing at a pace beyond the following of those who are not careful students of them, and some of their applications, as in machinery and medicine, are exerting daily practical effects on human life. Here in particular the itemizing principle is followed; to one general article of some length there are many brief notices in biology, botany, chemistry, physics, zoölogy, etc.

Alike in the unusual richness of its scientific department, in the abundance and variety of its more familiar topics, and in the convenience of its arrangement with reference to the wants of the average reader, this work appeals confidently to the American public.



A.

Aachen. See AIX-LA-CHAPELLE.

Aageson, SVEND. Danish chronicler, whose work extends to 1185.

Aakil Khan. Persian poet, at the court of Aurungzebe, who reigned 1658–1707. He wrote the romance called *The Taper and the Moth.*

Aall, JAKOB, 1773–1844. Norwegian statesman and historian; tr. *Heimskringla*, 1838–9.

Aarau, JOHN OF. First celebrated cannon-founder; cast his first cannon for Augsburg 1372; stones were then used for projectiles.

Aardvark. See VERMILINGUIA (*Edentata*). Earth pig of the Cape Colony, South Africa; snout and hairs alone give it a resemblance to a pig. Its ears are long, hind feet plantigrade, fore feet have no pollex, toes are armed with strong claws, tail is stout, teeth are a compound mass of prismatic ele-

Aardvark.

ments, each with a pulp cavity—there are sixteen or eighteen in all. It lives concealed in burrows by day and secures insects (ants, etc.) by means of an extensile tongue of moderate length. It burrows with great rapidity when pursued. The flesh is esteemed for food.

Aard-wolf. See VIVERRIDÆ.

Aargau. Swiss canton, bounded by Germany, Zurich, Lucerne and Basel. Pop. ab. 200.000.

Aaron. Elder brother of Moses, and first highpriest of Israel. His descendants alone admitted into the sanctuary, the other Levites only into the Temple courts. From Ezekiel xliv. some infer that before the Exile this distinction was less marked.

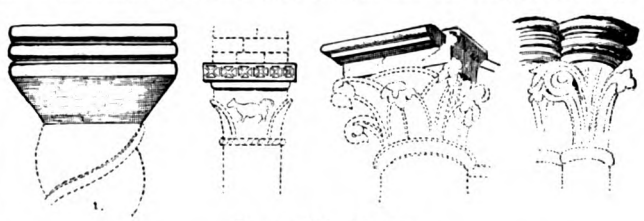
Aarsens, CORNELIS VAN, 1543–1624. Dutch statesman. His son FRANCISCUS, 1572–1641, was embassador to France, Venice and England.

Aasen, IVAR ANDREAS, b. 1813. Norwegian philologist.

Abaca. Name given to manilla hemp in the Philippine Islands, the fiber of the *Musa textilis*, a plant of the Banana Family.

Abactinal Surface. Upper or aboral surface of the starfish; surface attached to the stem in crinoids and branched polyps; convex surface of jelly-fishes.

Abacus. In mathematics, an instrument for making numerical computations of addition and subtraction, consisting of



Forms of the Abacus.

balls sliding on wires stretched in a frame. It was employed by the Greeks and Romans, and is still in universal use among the Chinese. In architecture, a shallow plate interposed between the capital of a column and the supported lintel or pier. It appears in all styles in which columns are employed. In the earliest examples from Egypt it is less in area than the capital, but in later styles wider. It is usually square in plan, but in many cases conforms to the shape of the capital: thus each face of the Corinthian abacus shows a concave curve, and in mediæval work, especially in English Gothic, it is often polygonal, circular or composed of a series of segments of circles.

Abad, DIEGO JOSE, 1727–79. Mexican Jesuit and Latin poet, exiled 1767. *Hervica de Deo Carmina*, 1769–80.

Abaddon. Hebrew equivalent of APOLLYON (q.v.).

Abae. Town of Phocis in ancient Greece, noted for a temple and oracle.

Abamurus. Wall built in order to strengthen another which shows indications of failure.

Abandonment. Intentional relinquishment of rights, duties or property. A right of way over another's land may be abandoned by acquiescence in an unlawful interruption. The duties of a husband or of a parent are abandoned by the willful refusal to perform them; those of a public office can be abandoned only as prescribed by statute. Property is abandoned by a voluntary relinquishment of one's title and possession, as where it is thrown away, or where it is surrendered by the insured to the insurer. Relinquishment of a military post district, or station, or breaking up of a military establishment. To abandon any fort, post, guard, arms, ammunition or colors without good cause is a military crime for which the officer in command is held responsible.

Abano, PIETRO DI, 1246–1315. Italian physician and astrologer, accused of magic; d. in prison. *Conciliator differentiarum.*

Abarbanel, ISAAC, 1437–1509. Portuguese Jew, who wrote upon the prophecies. His son, JUDAH (Leo Hebræus), ab. 1460–1520, pub. in Italian a Platonic *Dialogue on Love*, 1535.

Abaris. Scythian priest of Apollo, to whom the god gave a golden arrow, on which to ride through the air; came to Greece ab. 570 B.C.

Abatement. Destruction or diminution of a right, or removal of that which is illegal. At common law the title of an heir or devisee to land abates, *i.e.*, is destroyed, by the wrongful entry of a stranger after the ancestor's or devisor's death, and before entry by the heir or devisee. A legacy abates, *i.e.*, is proportionately reduced, when the assets are insufficient to pay all debts and legacies. A nuisance or unlawful annoyance may be abated or removed peacefully by the sufferer. Relief from a defective legal proceeding may be obtained by abatement. Revenue statutes often provide for the abatement or refunding of overpaid duties.

Abatis, or ABATTIS. An obstruction formed by strongly picketing branches of trees on the glacis in front of the ditch of a work intended to be defended against an assault. The butt ends are firmly anchored to the ground by pickets and the outer ends are sharpened and interlaced with each other, so that the obstruction cannot be easily removed, while at the same time it can afford no adequate shelter to the enemy. Like other accessory means of defense, an abatis is principally intended to delay the enemy in advancing upon the work, to break up his formation for assault and subject him to as great a loss in troops and *morale* as possible; it is therefore so placed as to be well within the close and accurate range of fire from the defended position.

Abattoir. See SLAUGHTER-HOUSE.

Abbadie, JACQUES, D.D., 1654–1727. French divine, settled in England 1689; dean of Killaloe 1699. His *Truth of the Christian Religion* was written in French, 1684, and tr. 1694.

Abbas I., or SHAH ABBAS THE GREAT, of Persia, 1557–1628. Came to throne 1582; defeated the Turks in great battle, 1605; made treaty with English, 1612; a ruler of great ability.

Abbas Pasha, b. 1874. Eldest son of TEWFIK PASHA; succeeded his father as Khedive of Egypt, Jan. 7, 1892; was educated at Vienna; has exhibited anti-English proclivities.

Abbásides, or ABBÁSIDS. Descendants of Abbas-ben-Abdul-Motalleb, uncle of Mohammed. After defeat of Ommiades by Abul Abbas, 750, 37 caliphs of this line reigned at Bagdad, till the Tartar conquest, 1258.

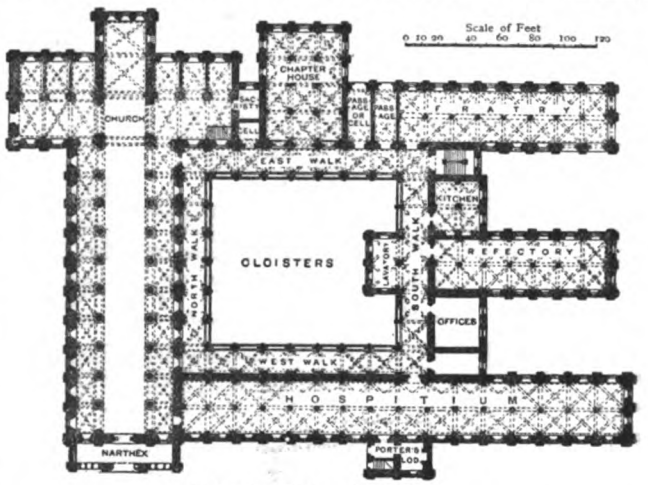
Abbé. French word for abbot, and, as laymen were often commendatory abbots, finally applied to any one who stood in a loose relation to the Church, in hope of ecclesiastical preferment, meanwhile pursuing literature, politics, or social influence; often a parish priest.

Abbe, CLEVELAND, LL.D., b. 1838. Director of Cincinnati Observatory, 1868; published its *Weather Bulletin*, 1869; meteorologist of U. S. Signal Service, 1871; prepared probabilities or storm warnings; was popularly known as "Old Probabilities"; began *Monthly Review* and *Bulletin of International Simultaneous Observations;* numerous astronomical and meteorological publications.

Abbess. Head of a female convent of the first rank. Some, who bear the pastoral staff, might, monastically, not sacerdotally, be called female prelates.

Abbeville. City of France, on river Somme; pop. ab. 20,000. A treaty was concluded here May 20, 1259, between Henry III. of England and Louis IX. of France, by which the former relinquished all claim to Normandy, Anjou, Touraine, Maine and Poitou. Another, between Henry VIII. of England and Francis I. of France, Aug. 18, 1527.

Abbey. Properly, a monastic or conventual establishment, presided over by an abbot or abbess: differing from a priory mainly in extent and in the title of the chief ecclesiastic, though priors were often subordinate officers in an abbey. The mitred abbots during the Middle Ages frequently rivaled their diocesan superiors in the extent of their establishments,



Cistercian Abbey—Model Plan.

and some abbey-churches, as Westminster and St. Albans in England, were architecturally as extensive and important as the cathedrals. Hence the term, in common usage, is often restricted to the abbey-church.

Abbey, EDWIN AUSTIN, b. 1852. American artist, resident in London since 1883; illustrator of Shakespeare and other poets of the past.

Abbey, HENRY E., b. 1848. American manager for many eminent actors and singers.

Abbot. Superior of a monastery of an order older than the 11th century. Mitred Abbots bear episcopal insignia, ordain their monks to the Minor Orders (the Abbot of Monte Cassino to the Subdiaconate) and enjoy prelatical rank and privileges, in some cases quasi-episcopal authority.

Abbot, EZRA, D.D., LL.D., 1819–84. Biblical scholar and critic; from 1872 prof. in Harvard Divinity School. His most important work was *The Authorship of the Fourth Gospel*, 1880.

Abbot, GEORGE, D.D., 1562–1633. Abp. of Canterbury, 1611. He was of the Puritan party and opposed Laud. *Geography*, 1599; *Exposition on Jonah*, 1600.

Abbot, HENRY LARCOM, LL.D., b. 1831. Lieut.-Col. U. S. Engineers. He served upon Pacific R. R. Survey, survey of Mississippi River; Military Engineer during Civil War; in charge of defenses of East River, N. Y.; authority and writer on war material. *Submarine Mines for Defending Harbors of U. S.*, 1881.

Abbott, BENJAMIN VAUGHAN, 1830–90. American writer on law. His principal works are the *Draft of a Penal Code*, 1865; *New York and National Digests*, 1870–85; *U. S. Courts and Their Practice*, 1877, and a Law Dictionary, 1879.

Abbott, CHARLES CONRAD, M.D., b. 1843. American naturalist. *Rambles about Home*, 1884; *Birds About Us*, 1894.

Abbott, CHARLES, Lord Tenterden, 1762–1832. Judge of Common Pleas, 1816; Chief Justice of the King's Bench, 1818; author of *Law Relative to Merchant Ships and Seamen*, 1802.

Abbott, EMMA A. (Mrs. E. J. Wetherell), 1849–91. American singer.

Abbott, JACOB, D.D., 1803–79. American writer of juvenile tales. His *Young Christian*, *Rollo Books*, 28 vols., *Franconia Stories*, and other series, were very popular. His brother, JOHN STEPHENS CABOT, 1805–77, wrote *The Mother at Home*, 1833, and many histories, including that of Napoleon.

Abbott, LYMAN, D.D., b. 1835. Son of Jacob. Editor since 1876 of the *Christian Union*, now *The Outlook*, and pastor since 1888 of Plymouth Church, Brooklyn, succeeding H. W Beecher. *Commentaries; Evolution of Christianity*, 1892.

Abbott Archæological Collection. Made by Dr. H. Abbott, during 20 years' residence in Cairo; owned by N. Y. Historical Society since 1860. A collection of European reputation, containing many rare and several unique finds; among the latter a gold ring with the cartouche of Cheops, constructor of the great Pyramid, an iron helmet and remains of iron scale armor of 10th century, B.C., and three mummies of the BULL APIS (q.v.) not found in any other collection.

Abd-el-Hamid. Arabic name adopted by Du Couret, a French traveler, b. 1812, who in 1834 began a journey through Egypt and Abyssinia to the Red Sea, and along its shores to

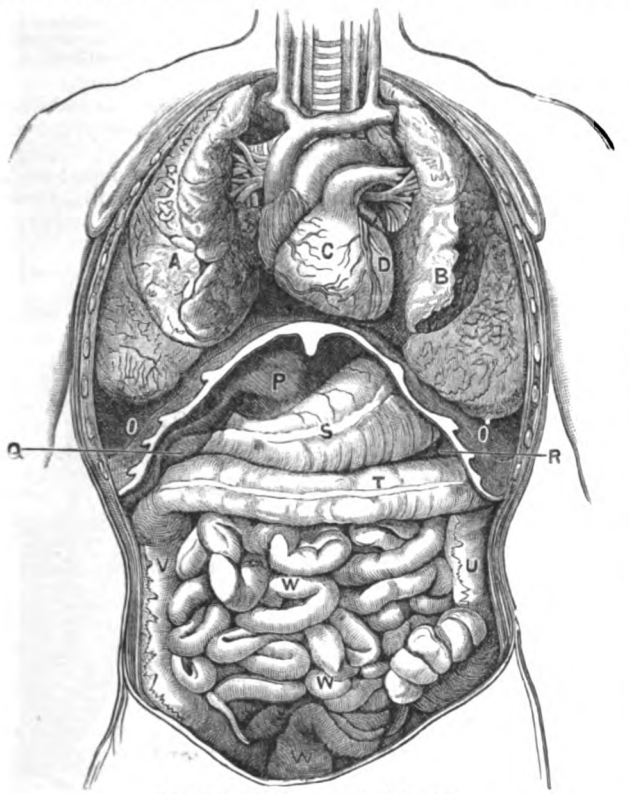
Cairo; became a Mohammedan, was imprisoned in Persia, returned 1847; was sent to Timbuctoo 1848; pub. 2 vols. 1855.

Abd-el-Kader, 1807–83. Arab chieftain. He defeated the French at Macta, Algeria, 1835, was conquered 1847, and imprisoned till 1852; protected the Christians of Syria 1860.

Abdication. Laying down of office by a monarch. The most noted examples are Diocletian, 305, and Charles V., 1555, voluntary; Napoleon, 1814–15, compulsory.

Abdiel. The faithful seraph who resisted Satan's solicitations to revolt. See PARADISE LOST, V., 896.

Abdomen. The "belly" of *Vertebrates*, or the part which incloses the liver, stomach and intestines. The posterior region of the body of *Arthropods*. In insects, it consists of ten



Organs of the Chest and Abdomen:
A, B, lungs; C, heart; OO, diaphragm; P, liver; Q, gall-bladder; R, spleen; S, stomach; T U V, colon; W, W, small intestines.

or eleven segments behind the leg-bearing region. In crustacea the segments are variable in number, freely movable, and often bear appendages, not, however, primarily used in locomotion. In scorpions, it is divided into a broad præ-abdomen and a narrow post-abdomen.

Abdominal Plates. Plate-like extensions of the external blastodermic layer of the embryo which project downward or forward to unite in the middle line, thereby forming the general body cavity within which in the adult lie the heart, lungs, intestines and organs concerned in the absorption of food, etc.

Abdominal Pores. Usually paired openings through the body wall into or near the cloaca in fishes and some reptiles. When functional they serve as outlets for the generative products. Not homologous with the atrial pore of *Amphioxus*.

Abdominal Pregnancy. Form of pregnancy in which the fœtus is developed either in the fallopian tube or in the abdominal cavity. Full development of the fœtus is rare, and unless destroyed or removed by operative measures, death of the mother is sure to ensue.

Abdominal Respiration. Breathing in which the muscles of the abdomen and the diaphragm are called into play more than those of the chest. It is more marked in men than in women, and always occurs in paralysis of the thoracic muscles.

Abdominal Ribs, or better, abdominal parosteal splints. Ossifications of the tendons of the rectus abdominis muscle of crocodiles and many fossil reptiles. They belong to the dermal exoskeleton, and are not homologues of the true abdominal ribs of certain birds. There are seven pairs in crocodiles.

Abdominal Scutella of snakes. Short wide scales that span the belly, and overlap with free edges behind. They are so attached to the body wall that as each pair of ribs swings forward the hind edges of the scales slip forward and become attached to any small projection or roughness, so that when the ribs swing back again the body of the snake is pushed forward. Thus can the serpent glide or walk without feet.

Abdominal Sternum. That which bears the abdominal ribs of crocodiles.

Abdominal Vein. See ANTERIOR ABDOMINAL VEIN.

Abdominales. PHYSOSTOMI with abdominal pelvic fins. Most of the more common fishes are thus characterized; but of the *Physostomi* we have four orders, or sub-orders: *Nematognathi, Eventognathi, Isospondyli*, and *Haplomi*.

Abdominalia. Barnacles characterized by having the body inclosed in a flask-shaped mantle. The alimentary tract is complete; the sexes are separate; there are three pairs of feet. These forms are parasites in other barnacles, or in *Mollusca*.

Abduction. In early English law, the taking away by force, fraud or persuasion of adult females for lucre and for marriage or defilement. It is now regulated by statute, and extends to the illegal taking of a child or a ward.

Abd-ul-Aziz, 1830–76. Sultan of Turkey 1861-76; deposed and probably murdered.

Abd-ul-Hamid II., b. 1842. Sultan of the Turkish Empire, succeeding his brother, Murad V., Aug. 31, 1876. Under his rule the Ottoman Empire has been dismembered of some of its fairest provinces. See BERLIN, CONGRESS OF.

Abd-ul-Mejid, 1823–61. Sultan of Turkey, 1839–61. He declared war with Russia Oct. 4, 1853, and, with aid of England and France, waged it until capture of Sebastopol, Sept. 1855.

Abdul Wasaa, d. 1148. Eastern poet, who wrote many works both in Arabic and Persian.

Abel. Protomartyr of righteousness in the human race. See CAIN.

Abel, SIR FREDERICK, BART., K.C.B., b. 1827. Associate member of Ordnance Committee, Chemist to War Department and chemical referee; high British authority and writer on powder and high explosives. *Guncotton*, 1866; *Explosive Agents*, 1884; *Electricity Applied to Explosive Purposes*, 1884. See POWDER AND EXPLOSIVES.

Abel, NIELS HENRICK, 1802-29. Swedish mathematician; author of brilliant memoirs on elliptic functions. Several important mathematical forms bear his name. His complete works were published by the Swedish Government, 1839.

Abelard, PIERRE, 1079-1142. French philosopher, best known through his romantic relations with Heloise. He led a life full of vicissitudes, at times followed by thousands of pupils, at others hiding and in disgrace. He was influenced by Aristotle, and introduced an element of rationalism into the scholastic theology. He held a position between the extreme realism of St. Anselm and the extreme nominalism of Roscellin. Heloise, a woman of great beauty and intellect, refused to marry him, lest this might interfere with his advancement in the church, and their relations were cruelly avenged by her uncle. His teachings were opposed by St. Bernard and condemned by the Council of Sens, 1141.

Branch and male Catkin of *Populus alba canescens*.

Abele. Silver-leaved or white poplar, *Populus alba*, native of Europe, but widely planted in America.

Abelian Equation. One in which one root is expressible as a rational function of another; solved by Abel through another equation of lower degree.

Abelian Function. A symmetric hyperelliptic function composed of inverses of Abelian integrals.

Abelian Integral. An integral of an algebraic function which may not be reduced to elliptic form.

Abelite. Explosive used for naval warfare; composed of nitroglycerine, gun-cotton, nitrate of potash and carbonate of soda.

Abelites. Sect of Christians, 4th century, in N. Africa. Followers of Abel, marrying, but having no children.

Abencerrages. Powerful Moorish tribe of Granada, opposed to the Zegris. Their quarrels, 1480–92, deluged Granada with blood, and hastened the fall of the kingdom.

Abenezra, IBN EZRA, or more fully ABRAHAM BEN MEIR BEN EZRA, 1090–1168. Jewish scholar, b. in Toledo and lived in several countries; author of commentaries on O. T.

Abensberg, Bavaria. Scene of Austrian defeat by Napoleon. April 20, 1809.

Abercrombie, JOHN, M.D., 1780–1844. Scottish writer. His *Intellectual Powers*, 1830, and *Moral Feelings*, 1833, were long used as text-books.

Aberdeen. City and seaport of Scotland, at mouth of river Dee, ab. 90 m. NNE. from Edinburgh. Pop., 1891, 121,905. Its University was formed 1860 by the union of King's College, founded 1494, and Marischal, 1593, and has about 800 students. A Free Ch. Col. was opened 1850.

Aberdeen, GEORGE HAMILTON GORDON, EARL OF, 1784–1860. Embassador to Austria 1813; member of Wellington's Ministry, 1828; received seals of Foreign Office, 1841. The conclusion of the Chinese war, the Ashburton treaty and the Oregon treaty fell within his administration. He resigned with Peel 1846; was called in 1853 to form a ministry, whose popularity was lost by vacillation and mismanagement during Crimean War; resigned 1855.

Aberdeen, JOHN CAMPBELL HAMILTON GORDON. 7th earl (1870) b. 1847. Lord Lieut. of Ireland 1886.

Abernethy, JAMES, b. 1815. Civil engineer; designer of methods for improvement of the Danube, of the docks at Cardiff and Hull; consulting engineer of the Manchester ship canal.

Abernethy, JOHN, 1764–1831. English surgeon.

Aberrancy. Angle formed by the normal at any point (P) of a curve, and a line from P to the middle point (L) of a chord parallel to the tangent at P. The line from P to L is the axis of aberrancy.

Aberration, CHROMATIC. As rays of different lengths, and hence of different colors, have different refractive indices, a single converging lens is unable to bring them all to a focus at a single point. This phenomenon is known as chromatic aberration. Thus the image of an object formed by a lens and projected on a screen is surrounded by a colored border, the color depending upon the distance from the screen to the lens.

Aberration, CONSTANT OF. Term applied to ratio of earth's velocity to velocity of light. 20.″445 is value commonly used in astronomical computations. Recent determinations give a somewhat larger value, about 20.″50.

Aberration of Light. Apparent change in direction of rays of light coming from a heavenly body, caused by combination of the velocity of ray of light with velocity of motion of the observer. It is treated under two heads: Annual Aberration, displacement due to earth's motion about the sun, and Diurnal Aberration, that due to revolution about its axis. The effect is to cause a star to appear a little in advance of its true position in the direction of the observer's motion. This displacement was noticed by Bradley, the English astronomer royal in 1728, who measured it accurately. The greatest angular displacement from a mean position is called the constant of aberration, and is 20″.445 of arc. If α represent this angle, then $\tan \alpha = \frac{s}{S}$, in which s is the velocity of the earth in its orbit, and S the velocity of light.

Aberration, SPHERICAL. When a beam of light is incident upon a spherical mirror or lens, the rays after reflection or refraction do not all come together at a single point on the principal axis. This deviation from exact concurrence is called spherical aberration, by reflection in the case of the mirror and by refraction in the case of the lens. Rays incident upon the circumferential parts of the mirror or lens cross the principal axis after reflection or refraction nearer to the instrument than those rays nearer the axis, and the distance between the point of crossing for the outside rays and that for rays nearest the axis is called the longitudinal spherical aberration. If now the rays be received on a screen, the image of a luminous point will be a circle of a radius varying according to the position of the screen; the diameter of the least image that can be formed is called the lateral spherical aberration. The envelope of a system of rays after reflection or refraction is called a "caustic." Parabolic reflectors and refractors produce no caustics, and hence no aberration.

Abert, JOHN JAMES, 1788–1863. Military officer and civil engineer, Chief of U. S. Topographical Engineers.

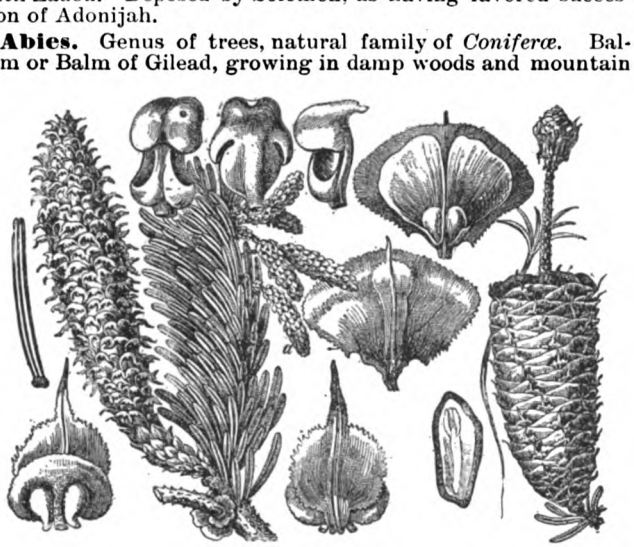
Abetting. Encouraging or inciting another to the commission of a crime. It may consist in simply resisting an attempt to prevent the crime.

Abeyance. Potential ownership, subsisting in contemplation of law. If land is granted to A for life, and then to B's heirs, the fee is in abeyance during B's life. The property rights of a bankrupt are in abeyance after the institution of proceedings and before the adjudication of bankruptcy.

Abgarus. Name (like Cæsar or Pharaoh) of several kings of Edessa, in Mesopotamia. There exists an apocryphal correspondence between one of them and Jesus.

Abiathar. Son of Abimelech, highpriest of Israel under Saul. Escaping from slaughter of his father's family, he followed David in his wanderings, and became joint highpriest with Zadok. Deposed by Solomon, as having favored succession of Adonijah.

Abies. Genus of trees, natural family of *Coniferæ*. Balsam or Balm of Gilead, growing in damp woods and mountain



Abies Picea.

swamps from Newfoundland to Pennsylvania, is *Abies balsamea*, yielding the Canada balsam of the shops. *Abies Canadensis* (hemlock) is now transferred to the genus *Tsuga* (*T. Canadensis*). See PICEA and PINUS.

Abietic Acid. $C_{44}H_{64}O_5$. Main constituent of ordinary rosin or colophony. Diabasic; sodium salt in rosin soap. Present in rosin oil. A white crystalline solid.

Abelmoschus moschatus, *Moench*. Natural family *Malvaceæ*, from India, and naturalized in tropical America; yield *Musk Seed*. They are used in perfumery as a substitute for musk.

Abigail. Elder sister of King David, and mother of the general AMASA (q.v.).

Abimelech. (1) Family name of a line of Philistine kings, of upright and friendly characters. (2) An illegitimate son of the Hebrew hero Gideon. Murdering his numerous brothers, he became king in Shechem, but three years later perished during a revolt.

Abiogenesis. Spontaneous generation, creation or production of a living being from not-living matter. Supposed to have taken place when the first life appeared. As it has been shown never to take place now, it seems likely that, in a strict sense, it never did take place. The conclusion must be that life is as eternal as matter.

Abipones. Tribe of Indians in the Gran Chaco, Argentine Confederation, w. of the Parana. Nearly extinct, numbering to-day 100, against 5,000 in 1783.

Abiram. Reubenite, involved in the rebellion and destruction of the Levite Korah.

Abishai. Son of King David's elder half-sister Zeruiah, and brother of Joab, whose ruthless measures he supported.

Abitus. See APHODUS.

Abjection. Term employed in Botany to express forcible casting off of seeds or spores.

Abjunction. Method of spore formation, obtaining especially in fungi; the terminal portion of a cell is cut off by partition and falls away as a spore.

Ablaut. German word meaning gradation of sound, and usually applied to the change of vowels by which words of the same root vary in meaning or application; e. g., *drink, drank, drunk.*

Abner. Cousin and commander-in-chief of King Saul, and of his son Ishbosheth. Making overtures to David, who promised him the same rank, he was treacherously murdered by David's nephew and chief general, Joab, who had a blood-feud with him.

Abneural. Pertaining to side of an animal opposite to that where the nervous system lies; thus, in a back-boned animal the abneural side is the belly, because the back bone incloses spinal cord. In an insect or other non-vertebrated animal, abneural side is usually carried up; *i. e.*, looking skyward —the opposite of what is true in Vertebrates.

Abo. Town of Finland, its capital till 1819; founded 1157; pop. about 28,000. By the Treaty of Abo, Aug. 18, 1743, Sweden ceded part of Finland to Russia.

Abode. A person's dwelling-place, temporary or permanent. One's permanent abode is ordinarily his domicile.

Abomasum, or RENNET STOMACH. Fourth and final compartment of stomach of *Ruminants.* Contains true gastric glands, and in it the real digestion takes place. The "cud" reaches this compartment by being strained through the manyplies.

Aboral. Pertaining to region at the pole opposite the mouth in *Radiates.* All radiated animals are considered as having a central axis whose position is usually vertical, and whose ends are the "poles." In those polyps which are fixed by a stalk the mouth is on the upper end; *i. e.*, the stalk is attached to the aboral pole.

Aborigines. Original or primitive inhabitants of a country. See INDIANS, AINOS, AUSTRALIANS, AZTECS, etc.

Aborted. Said of an organ that should typically be present, but has been suppressed in development.

Abortion. As a criminal offense, maliciously producing the premature birth of a child without legal excuse. Under most modern statutes, it is not necessary that the mother be quick with child, nor does her consent affect the abortionist's crime. In medicine, the expulsion of the fœtus from natural causes before the fourth month; from the fourth to the sixth month it is called miscarriage; after the sixth month premature labor. Also, term employed in Botany to indicate non-development of organs which are present in typical structures, also known as SUPPRESSION.

Aboukir. Village of Egypt, 13 m. n.e. of Alexandria; once Canopus. Here Nelson defeated the French fleet in the bay, Aug. 1, 1798, and Bonaparte, with 5,000 French, defeated a Turkish army of 15,000, July 25, 1799. It was surrendered to the English, after a sanguinary conflict with the French, March 8, 1801.

Aboukoff. See GUN FACTORIES.

Aboul Mefa. Arabian astronomer of the 10th century; he lived at Cairo, and discovered the third inequality of the moon's motion, known as the variation.

About. Technical military word used to express movement by which a soldier, a body of troops or a battery of artillery changes front: as *about face, right* or *left about.*

About, EDMOND, 1828–85. French novelist and satirist. *Contemporary Greece,* 1855; *King of the Mountains,* 1856; *The Roman Question,* 1860.

Abrabranel. See ABARBANEL.

Abraham. Father of Isaac and Ishmael, grandfather of Jacob, and through him ancestor of the Israelites. He came from Mesopotamia, and is the chief Biblical example of faith.

Abranchiata. (1) Group of VERTEBRATES, including SAUROPSIDA and MAMMALIA, same as AMNIOTA. (2) Division of ANNELIDA, characterized by absence of external branchiæ, as in earthworms and leech. (3) Subdivision of GASTROPODS (*Apneusta, Dermatopnoa*), related to *Nudibranchs,* including *Limapontidæ, Phyllirhoidæ, Elysiidæ.* (4) Also written ABRANCHIA, and variously applied when branchiate and non-branchiate forms are contrasted in classification, as in Arthropoda, contrasting land forms with Crustacea.

Abraum Salts. Mixture of sulphates and chlorides of magnesium and potassium overlying the rock-salt deposit at Stassfurt, Prussia.

Abraxas grossulariata, or HARLEQUIN. A butterfly with white wings speckled black.

Abraxas Stones. Term applied generally to the gems of the GNOSTICS (q.v.), but derived from one especial class cut

Abraxas grossulariata.

Abraxas Stones.

with the Greek letters Abrasax (not Abraxas). These letters represented numerically the 365 successive emanations of the creative principle, as worshiped by the Gnostics.

Abrupt Point. One where a curve stops suddenly; called also stop-point or point d'assét (French).

Abrus precatorius. Graceful, twining plant of natural family *Leguminosæ;* indigenous to India, but now growing wild in all tropical countries, and grown, as an ornamental plant, in greenhouses in temperate countries. Known by common name of Indian Liquorice, or Wild Liquorice; flowers are rose-colored, on one-sided, long-stalked raceme; pods contain 4 to 6 scarlet-colored seeds, of size of a small pea, with black spot at hilum; are used for making rosaries and necklaces, hence are called prayer-beads, and sometimes jumble-beads or crabs'-eyes; whole plant has sweet taste, and root is used like liquorice root in tropical countries; seeds are also used in India as a standard of weight by Hindoo jewelers and druggists. Each seed is estimated equal to 2 3-16 grains. Seeds were introduced to Europe and America in 1882 under name of *Jequirity,* and a weak decoction has been employed for cure of granular eyelids, but in some cases severe inflammation followed its use.

Abruzzi. District of south central Italy, lat. 42°–43°, including part of the Apennines. It formerly belonged to Naples.

Absalom. Third son of David, eminent for beauty. Having murdered his half-brother Amnon, the eldest son, in revenge for a scandalous wrong done to A.'s sister Tamar, and despairing of being nominated David's successor, he rebelled against his father and drove him across the Jordan, but was defeated and slain.

Absalon, or AXEL, 1128–1201. Abp. of Lund, Primate of Denmark and Sweden, 1178; famous as scholar, statesman and warrior.

Absaroka Range. In southern Montana and northwestern Wyoming, separating the Yellowstone and Bighorn Rivers; elevation, 10,000 to 12,000 feet; composed in southern part of volcanic conglomerate, changing to granite in northern part.

Abscess. Collection of pus inclosed in a cavity formed by the tissues in which it is found, or in one lined by a membrane which in old chronic varieties has acquired the property of secreting pus; may be the result of injuries which bruise the parts, or of disease or death of an organ or tissues; when in an organ necessary to life, such as the brain, they result fatally as a rule, and when the pus escapes into any of the cavities of the body or into a joint, serious inflammation is set up; cold abscesses are those which form slowly, give rise to few symptoms and are hard to relieve. Treatment in all cases consists in the removal of the pus and measures to promote the growing together of the walls of the cavity and measures to build up general strength.

Abscissa. One of the two lines determining position in Cartesian system of co-ordinates. The abscissa of any point is distance of that point from the axis of ordinates measured on or parallel to the axis of abscissas.

Absence. Military offense on part of an enlisted man when he absents himself from his post or company without proper authority. If convicted by court-martial, army regulations provide that he shall forfeit all pay and allowances accruing during such absence and make good time lost. An unauthorized absence for ten days or more may be charged against him as desertion a military crime of a much more serious character.

Absence, Leave of. Permission granted to officers of the army to absent themselves from duty at the post where they are serving, for a definite period; commanding officer may grant a week's leave to an officer, but for a longer period, authority of the War Department is requisite. A corresponding leave to an enlisted man is called a furlough.

Absinthe. An alcoholic liquor, flavored by the plant Artemisia Absinthum, wormwood, containing absinthin, an aldehyde. It is best prepared in Switzerland. The dried and ground plant, with green anise and fennel, is digested in alcohol, diluted with water and distilled. The last third of the distillate is digested with small wormwood, hyssop and lemon balm, strained and added to the first two-thirds. This is then diluted with water to 75 per cent alcohol. Inferior qualities are made, without distillation, by flavoring alcohol with essential oils. It improves with age, losing its sharp and empyreumatic taste. It is drank diluted with water, when it is opalescent. Continued abuse deranges digestion, effects the nervous system, induces epileptic convulsions and paralysis. Magnan, French physician, noted 250 cases in Paris in three years. Much drank in France.

Absolute, The. In philosophy, variously conceived. By one school it is synonymous with God minus personality, or at least does not necessarily imply this property. First Cause is also an equivalent. Another school conceive it as denoting that which exists out of all relation, and so oppose the term to the Relative. The true meaning, which is not exposed to the objections of the second conception, is that which exists out of the relation of dependence upon another, but in relation as its cause. The relation in this view would be that which exists only as an effect and never as a first cause.

Absolute Alcohol. $C_2H_5.OH$. Ethyl or ordinary alcohol from which water has been removed and is chemically pure alcohol. Made by distilling alcohol from lime, then allowing it to stand over anhydrous copper sulphate and finally over metallic sodium. Purity not over 99.8 per cent. Sp. Gr. 0.793 at 60° F.

Absolute Ethics. Expression used by H. Spencer to indicate a code of ethics whose injunctions alone are absolutely right, and which may serve as a system of ideal conduct to be referred to in solving the problems of real conduct where actions are only relatively right. Used in opposition to Relative Ethics.

Absolute Moisture. See Hygrometry.

Absolute Space. Space regardless of material form or limit.

Absolute Temperatures. Temperatures reckoned from absolute zero (q. v.), which is 459°.4 below Fahrenheit zero, and 273° below Centigrade zero. Temperatures in the formulæ of Thermodynamics (q. v.) are expressed in these units, using T as initial to represent them. In any gas, if P denote pressure, and V denote volume, $\frac{PV}{T}$ = a constant. The mechanical work, which can be done by heat during any change of arrangement of a body, is proportional to absolute temperature at which that change occurs.

Absolute Zero. Temperature of a body entirely without heat, *i.e.*, where heat motions or oscillations have entirely disappeared. Its position on any thermometric scale is thus found. Regnault and others have shown that perfect gases change by $\frac{1}{273}$ of their volume at 0° Centigrade for each 1° C. If therefore a unit of volume at 0° C. be cooled still further, it will grow smaller by $\frac{1}{273}$ of itself for each degree, and at 273° below 0° C. it will have reached a volume at which further refrigeration can have no effect, and hence will be no heat vibrations to be affected. Absolute zero is therefore at −273° C. For the Fahr. scale the co-efficient is $\frac{1}{491.4}$ for each degree reckoned below 32° F.; hence absolute zero on this scale is 491.4−32=459°.4 below Fahrenheit zero.

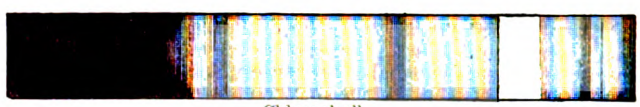
Absolution. In Catholic theology, a judicial act of a validly ordained priest of competent jurisdiction, remitting the eternal punishment of mortal sins which a penitent has frankly confessed with at least the imperfect repentance called attrition, and a firm resolution of avoiding them hereafter. In danger of death any priest, even if degraded, excommunicate or apostate, can absolve any penitent from any sin. Such a confession and absolution (implying suitable self-mortification), constitute the Sacrament of Penance.

Absorbents. Lacteal and lymphatic vessels, more particularly those connected with the intestines, which absorb digested food, convey it into general circulation, and also take up certain bodies at all points in the body; as, *e.g.*, the poisonous matters in unhealthy wounds, albuminoids or drugs injected beneath the skin, the products of inflammation, etc.

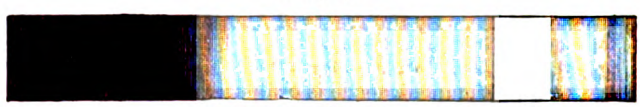
Absorbing Power. That property of a substance in virtue of which it converts a greater or less portion of incident radiant energy into heat. Its value is the ratio of the energy absorbed to the whole amount incident. Lampblack is one of the best absorbers known; its absorption is practically independent of the wave length. See Occlusion and Solution.

Absorption. Process by which digested food is taken up by the system. The principal and most important factors are the blood vessels and lymphatics of the intestines. Fatty matters and soluble salts may be absorbed to some extent by the skin, and albuminoids by the peritoneum and membranes lining the other cavities of the body and the tissues, when injected into them. In Botany the taking in of gases and liquids by growing plants through the epidermis and its various appendages, stomata, lenticils, trichomes, etc.

Absorption Bands. In spectroscopy, when a bright light passes through a body, which may be a vapor, solution or solid, dark bands are observed in the spectrum.



Chlorophyll.



Uranium Chloride.

Absorption Lines. When a bright light is projected through a flame, in which elementary substances are vaporized, the peculiar lines, observed by the spectroscope, are replaced by dark lines in the continuous spectrum.

Abstinence. Avoidance of any form of food, drink, or pleasure; applied especially to beverages which may intoxicate, and opposed alike to over-indulgence and to temperance or moderate use. Total abstinence societies have existed in the U. S. from 1808.

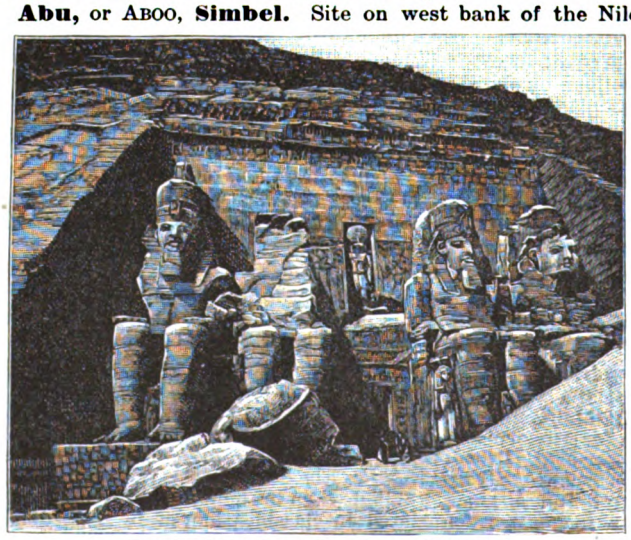
Abstraction. Several psychological phenomena of importance. (1) That degree of mental occupation which makes the person oblivious of surrounding circumstances and objects which would naturally come within the field of attention. (2) More technically, the mental act of conceiving a mere property of an object as a thing, and neglecting all other concomitant properties and relations as if they did not exist. (3) Often in a popular sense "an abstraction" is taken to be some thing or conception which cannot be expressed in material or physical terms, and is synonymous with the unpicturable.

Abstract of Title (brief of title or search). Synopsis or summary of all conveyances, liens and charges affecting the title to an estate in lands. In England the vender of real estate is bound, and in the U. S. he is accustomed, to furnish an A. of T.

Abstriction. Term employed in Botany to separation of one part of a plant from another by constriction and formation of a septum.

Abt, Franz, 1819–85. Prolific German composer of songs for voice and pianoforte and male chorus. His best known song is *When the Swallows Homeward Fly.*

Abu, or Aboo, **Simbel.** Site on west bank of the Nile,



Façade of the Great Temple at Abu-Simbel.

between the first and second cataracts; famous for two rock temples dating from Rameses II., ab. 1350 B.C. The temple façades are cut in the face of the rock, which overlooks the

river. The larger temple's façade boasts of four colossal seated portrait figures of Rameses II., each about 66 ft. in height.

Abu-Abdallah. See BOABDIL.

Abulfaragius, GREGOR, 1226–1286. Of Jewish origin; became bishop of Guba and afterward of Aleppo, where he was made, in 1266, Maphrian or primate of the eastern division of the Jacobites; famous as philosopher, linguist and theologian. His greatest work is a *History of the World* in Syriac, of which he made an Arabic abridgment. We possess a Latin version of the latter.

Abulfazl, d. 1608. Vizier of Akbar, the Mongol emperor, whose biography, entitled the *Akbar Nameh*, or Book of Akbar, he wrote.

Abulfeda, ISMAEL BEN ALI EMAD-EDDIN, 1273–1331. Arabian prince, b. at Damascus. He took part in the wars against the Crusaders, and was a patron of learning. His work on geography is extant; also portions of his *Abridgment of the History of the Human Race.*

Abulghazi-Bahadur, 1605–1663. Khan of Khiva, who abdicated his throne and in retirement wrote a history of the Mongols and Tartars.

Abul-Teman, 806–845. Arabian poet, so famous that the proverb says, "No one could ever die whose name had been praised in the verses of Abdul-Teman." He also pub. three collections of Oriental poetry, the *Hamasa* being the best.

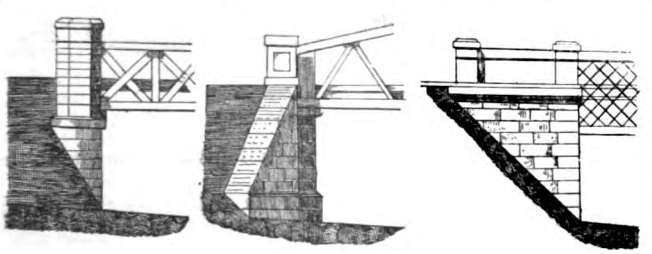
Abuna. See ABYSSINIAN CHURCH.

Abundant Number. One less than sum of aliquot parts, Ex. $30<1+2+3+5+6+10+15$. Distinguished from deficient number and perfect number.

Abuse of Authority. The authority invested in all persons belonging to the military hierarchy is clearly defined in the Articles of War, regulations of the army and general orders emanating from War Department from time to time. In exercise of this authority the rights of individuals as well as the good of the service are to be considered, and no unjust discrimination should be exercised for gratification of personal spite or attainment of petty ends.

Abutilon. Genus of *Mallow* family, comprising several species with showy flowers, cultivated for ornament.

Abutment. Mass of masonry which resists the outward push of an arch. When a bridge has several spans the ma-



Abutments.

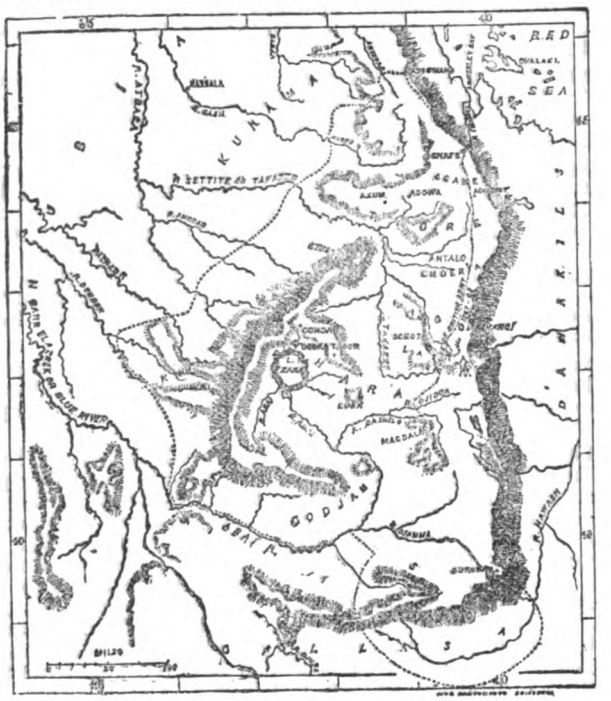
sonry supports nearest the shore are sometimes called abutments, and the others are called piers. See ANCHORAGE.

Abydos. Town of the Troad, just above which Xerxes built his bridge of boats over the Hellespont, 480 B.C.

Abydus. Egyptian site (also called Thinis), famous for its ruins of two temples dating from the eighteenth dynasty, ab. 1400 B.C.

Abyssal Clay. Deposit found covering the ocean bottom at depths exceeding 3,000 fathoms. It consists of an impalpable red clay mixed with volcanic and meteoric matter. The first ingredient is probably the residuum left after solution of the shells of pelagic animals during their long descent to the bottom.

Abyssinia. Country of eastern Africa, south of the Soudan, containing an area of nearly 200,000 sq. miles. Its surface is much diversified, consisting of high mountain ranges 12,000 to 13,000 ft. above sea, and elevated table lands 6,000 to 10,000 ft. high, among which are numerous deep valleys. It is drained mainly by the Blue Nile and other branches of that river. The inhabitants are of various races, but mainly Caucasian, nominally Christian, and in manners are rude and barbarous. The government is a hereditary monarchy. Pop. 3,000,000 to 4,000,000. The kings claim descent from the Queen of Sheba. Christianity was introduced ab. 350; monks came in numbers ab. 470. In consequence of the search for PRESTER JOHN (q.v.), the Portuguese began missions here ab. 1490. The Mohammedans overran the country 1528–40, and the aid of Portugal was invoked; hence a period of Jesuit ascendancy, ending with their expulsion in 1633. (See THEODORE II.) The English took



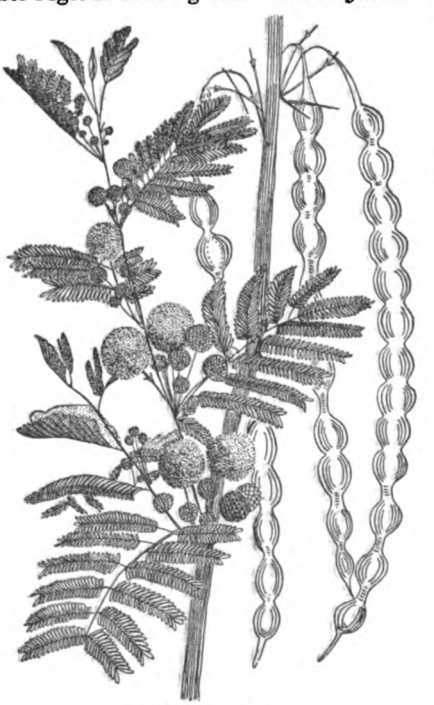
Sketch Chart of Abyssinia.

Magdala 1867. Menelek II., king of Shoa, gained the throne 1889.

Abyssinian Church. Branch of the Coptic, holding with it Monophysite doctrine. It received its first bishop or abuna (father) from Alexandria. Exceedingly irregular and barbarous, but stoutly maintaining its independence.

Abyssinians. Probably of Asiatic origin; Christians, Jews (proselytes), and Mohammedans, but with retention of some pagan practices; one aboriginal practice, wife-capture, is practiced as a mere ceremony. The wife enjoys much social liberty in spite of the absolute power of rule in the husband.

Acacia. Genus of *Leguminosæ*, trees or shrubs, native of the warmer regions of the globe. *A. senegal* and *A. arabica*



Acacia arabica.

produce gum arabic by spontaneous exudation. Catechu or cutch is an extract prepared from *A. catechu.*

Acacia, FALSE. See LOCUST.

Acacia, THREE-THORNED. See LOCUST, HONEY.

Acacius, d. 366. Arian theologian, Bp. of Cæsarea 340–365. He and the sect of Acacians held that the Son resembled the Father in will, but rejected the terms Homoousian and Homoiousian alike.

Académie de Musique. Official title of the Grand Opéra in Paris, a State institution founded 1669, receiving an annual subvention, and managed by a director subject to the Minister of Fine Arts.

Academies to Regulate Language. The best known institution of this kind is the French Academy, founded 1635 by Richelieu, and intended to fix standards for the national speech. It has made the well-known dictionary, and is still a court of appeal in all questions of linguistic accuracy. Its other functions belong to literature. Similar institutions have been founded in other countries, as the Royal Academy of Spain, 1714, or the older *Accademia della Crusca* of Italy, Florence, 1582. See INSTITUT NATIONAL

Academy. Plot of ground near Athens, adorned with plane and olive trees, and containing a gymnasium in which taught Plato, and afterward his followers, hence called academic philosophers.

Academy, Military, U. S. At West Point, N. Y. Institution established by law for the instruction of young men preparatory to their promotion into the U. S. Army as commissioned officers. It is commanded by an officer of rank as superintendent, under the direct supervision of the War Department. An Academic Board directs and controls its system of studies and methods of instruction, subject to the approval of the Secretary of War. Its staff of instruction consists of about fifty officers specially selected from the army and detailed for four years' duty, after which they are returned to their proper stations, and of seven professors permanently attached to the institution. The students are warrant officers recommended by representatives of Congress and appointed by the President. They must be actual residents of the Congressional District from which they are appointed and of legal age (17 to 22 years), and before they are admitted must pass a preliminary examination in the simpler branches of learning taught in the common schools. The course of instruction extends over four years. Each cadet receives pay, amounting to $540 per year, which covers every possible expense for his support, clothing and books, and leaves sufficient to pay for his officer's equipment on graduation. It is essentially a national school, whose pupils are wards of the Government and are drawn from every section of the country. From 1800, the date of its establishment, to September, 1894, there were admitted into the institution 7,582 cadets, of whom 3,616 have been graduated.

Academy of Natural Science, Philadelphia, Pa. Founded 1812. Association of scientists, holding meetings for the reading of papers and discussion. It publishes Proceedings and Journal.

Acadia. Name borne by the province of NOVA SCOTIA (q.v.), while under French dominion.

Acadian. Lower part of the Ordovician strata in North America.

Acalephæ. See SCYPHOMEDUSÆ, which group contains most of the A.: others belong to the *Trachymedusæ*.

Acanthaceæ. *Acanthus* family. Chiefly tropical herbs or shrubs, with irregular, more or less two-lipped corolla, and a two-celled capsular fruit, with a variable number of seeds, hanging by hard cupshaped or hooked projections. There are nearly 1500 species, generally unimportant. Some are mucilaginous and bitter. The principal genera are *Acanthus*, *Andrographis* and *Ruellia* (q.v.).

Acanthin. Horny substance allied to chitin, which composes the skeleton of certain Radiolaria. It is destroyed by red heat and acids.

Acanthite. Ag_2S. Rare silver sulphide of the same composition as argentite, named from its occurring in thorn-shaped crystals. Found in Saxony and Bohemia.

Acanthocephala. Round worms (NEMATHELMINTHES) having a body somewhat elongated, a proboscis covered with hooks and which can be retracted into a sheath, on each side of which lie lemnisci. The internal structure is complex and well developed: the embryo develops larval membranes. They are parasitic in minute animals, which being taken in the drink of Vertebrates, occasions them to pass the later stages of their development in the intestines of these animals.

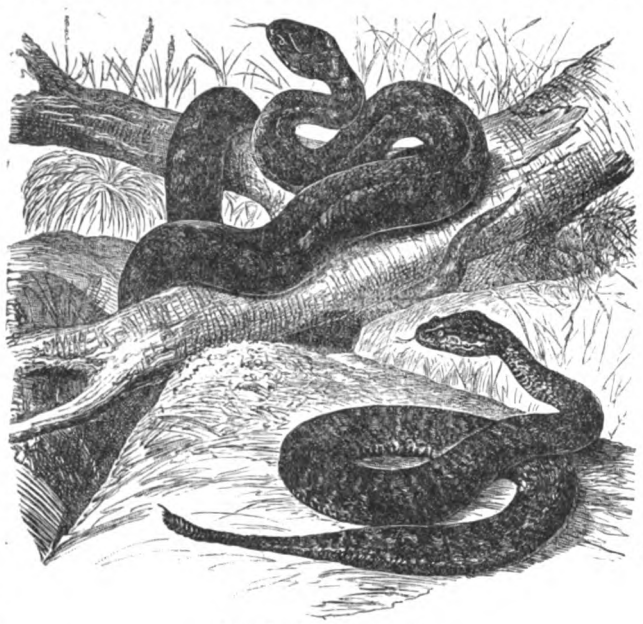
Acanthodidæ. Order of *Ganoids* including palæozoic fossils having small shagreen-like scales, heterocercal tail, spines in front of some of the fins, cartilaginous skull, and no operculum. They unite the Ganoids and Sharks.

Acanthometra. Genus of Monozoic *Radiolaria*. See ACANTHOMETRINA and ACANTHOMETRIDÆ.

Acanthometridæ. Family of *Entolithia*, including *Radiolaria*, whose radial spicules pierce the central capsule, but do not form a capsular basket. These also have no yellow cells. See ACANTHOMETRINA.

Acanthometrina. Sub-class and order of *Radiolaria*, including small, spherical, protozoan bodies floating on the ocean surface. The sarcode is supported by siliceous or horny spines, the former are hollow and transmit pseudopodia. The spines radiate from a common center, in the form of a double cone in *Diploconida*. In other sub-orders there are twenty spines (except in the *Litholophidæ*, in which the number is indefinite), that are united at their apices by a perforated shell in *Sphæro capsida* and are united by transverse bars in *Dorataspida*. In *Acanthonida* there is no union of the spines except in the center; they lie in five zones of four spines each.

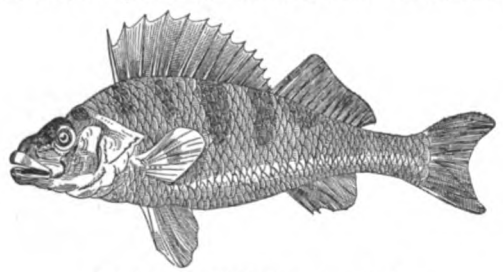
Acanthophis. Genus of poisonous snakes, of the family *Elapidæ*. The *A. antarcticus* is the death-adder of New South



Acanthophis antarcticus.

Wales. The horny tip at end of tail gives the name to the genus.

Acanthopteri, or ACANTHOPTERYGII. Order of physoclist fishes characterized by the presence of one or more spines at the beginning of the dorsal and other fins. The gills are comb-like, the pelvic fins are thoracic. In its most unre-

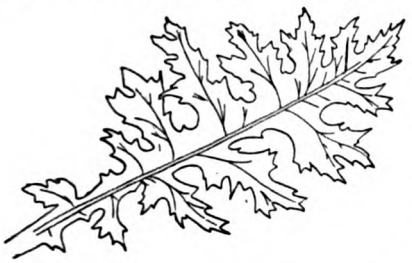


Perch, an Acanthopterygious Fish.

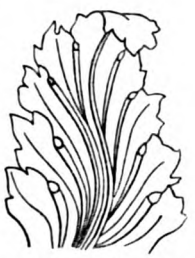
stricted sense five sub-orders are included: (1) *Pharyngognathi*, including the *Labridæ;* (2) *Hemibranchii* including the *Gasterosteidæ* and trumpet fishes (*Fistulariidæ*); (3) *Pediculati*, including forms like the fishing frogs (*Lophius*); (4) *Opisthomi*, the "spiny eels"; (5) *Acanthopteri*, restricted: this includes the *Scombroids*, such as the mackerel, bluefish, pilot-fish, dolphin, tunny, swordfish, etc; the *Chætodonts*, the *Percoids*, such as weakfish, redfish, drumfish, porgie, sheepshead, blackfish, red grouper, jewfish, rockfish, perches, darters, bass, sunfish; the *Ophiodoids*, such as *Fierasfer* and many others. See the above, also GOBY, GURNARD, TOAD-FISH, LABRIDÆ, WOLF-FISH, COTTIDÆ, CHIASMODONTIDÆ.

Acanthus. Genus of plants, the typical one of the family *Acanthaceæ*. The species of A. have large lobed and sinuate leaves. *A. mollis* of southern Europe and cultivated in Britain has mucilaginous properties and may be used as a substitute

for marshmallow. *A. spinosus*, indigenous to Greece and the islands of the Grecian archipelago, supplied the motive for the decoration of the Corinthian capital. The legend related by Vitruvius is that the sight of a basket overgrown with the



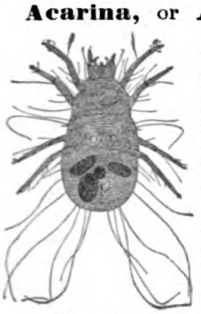
Acanthus spinosus, natural.



Ornamental Acanthus Leaf.

leaves of the A. suggested to an Athenian sculptor, Callimachus, the idea of the Corinthian capital, which was the precursor of all other foliaged capitals. Is clear that the leafage of the Corinthian capital is derived from the plant.

Acarina, or ACARIDA (Mites). Arachnids with stout oval bodies. The cephalothorax is fused with the unsegmented abdomen. Mouth parts are adapted for biting, piercing and sucking. Respiration is effected by tracheæ. Most Mites are parasites; large blood-sucking forms are called Ticks. *Demodex*, *Sarcoptes*, *Ixodes* and *Trombidium* are troublesome to man. See MONOMEROSOMATA.



Cheese-mite.

Acarnania. District in western part of Greece, first brought into view in Peloponnesian war, 431 B.C. Its inhabitants were less civilized than in the rest of Greece.

Accad. City mentioned Gen. x. 10; probably on the Euphrates, nearly w. from Bagdad. Sargon I., the earliest king of Babylonia of whom anything is known, ruled here about 3800 B.C. Ishtar, or Anunit, was the chief deity. A. is the name also of the northern section of Babylonia, Sumir being the lower or southern section.

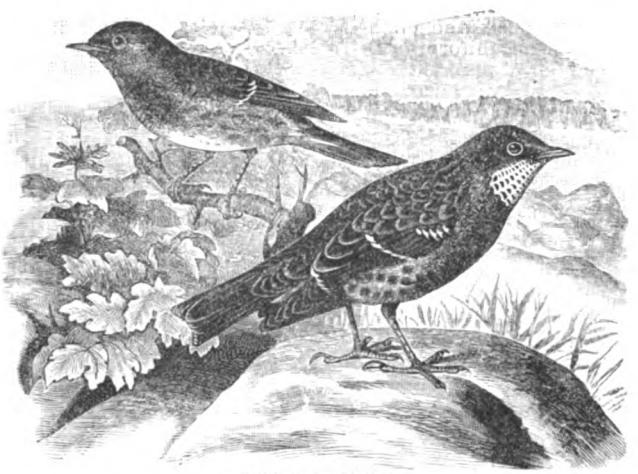
Accadian. Dialect of the speech of Babylonia, belonging to the Semitic family, and famous for its cuneiform (wedge-shaped) inscriptions.

Acceleration. (1) Rate of change in the velocity of any moving body. A number of units of length in one unit of time, and the difference between the velocity observed at the end of one unit of time and the velocity at the end of the next succeeding unit. Where this difference is negative, the motion is being retarded. Acceleration may be uniform or varied. The most usual of the uniform accelerations is that due to gravity, which produces a change of velocity of 32.2 feet per second when a body falls or is thrown upward into the air. There are also astronomical accelerations observed in the motions of the heavenly bodies—due, for the planets and fixed stars, to the orbital motion of the members of the solar system; the apparent acceleration of the moon has not been fully explained. (2) Occurrence of the stages of development of an animal earlier and earlier in its life history as the generative cycles are repeated; *e.g.*, the lower Crustacea hatch as free swimming *Nauplius larvæ*, while in the higher this stage is passed in the egg, the free larva here corresponding with the adults of lower forms. See DEVELOPMENT.

Accent. Aside from its use to indicate a mark or sign of pronunciation, the stress or loudness of voice laid upon a particular syllable, word, or phrase. Also, the pitch, or relative sharpness of tone, as in the classical languages. In these, as in oldest Germanic, the accent was movable, and varied with varying forms of the word; whereas, in English, as in the historical Germanic dialects, the accent falls upon the initial syllable of the word. Many words, however, which we have taken from the French, retain their original accent. Accent is the chief factor in modern rhythm, as compared with classical quantity.

Accent in Music. Emphasis or stress regularly laid upon certain tones, designated generally by their position with relation to the bar across the staff. Unless explicitly displaced the accent falls upon the first note in each measure; exceptions to the rule are created by forcing dynamic stress upon other parts of the measure, or by binding an unaccented to an accented note by a slur, the stress being thus displaced. Accents used in instrumental music are generally called grammatical or metrical. In vocal music there is also oratorical, rhetorical, æsthetic or pathetic accent, by means of which the musical expression is made to conform to the sense of the words. Ecclesiastical accents are simple melodic formulas used in reciting portions of the church liturgy.

Accentor modularis (Hedge-Sparrow). Bird of family



Accentor modularis.

Sylviidæ. The golden-crowned thrush belongs to family *Sylvicolidæ*.

Accession. Title by which the owner of property holds that which becomes accessory to it. Owner of the female had title by accession to her progeny. Owner of land becomes owner of whatever is permanently affixed to it.

Accessory. Botanical term for a fruit composed of an enlarged receptacle or adherent surroundings of a simple or aggregate fruit. Such are also known as anthocarpous; also applied to buds when additional ones occur in the same axil which bears the main one.—Legal, before the fact, at common law, one who is absent at the commission of the felony, yet procures, counsels or commands the crimes; after the fact, one who, with knowledge that a felony has been committed, receives, relieves, comforts, or assists the felon. In misdemeanors there are no accessories; all are principals. Modern statute generally treat accessories before the fact as principal offenders.

Accessory Foods. Spices, condiments and beverages, such as pepper, tea and coffee, largely used to stimulate and aid digestion, but containing none of the elements necessary to life.

Accessory Means of Defense. All those artificial and natural obstacles which are found or can be placed in front of assailed positions and so arranged by the military art as to break up the assailant's formation for assault, or delay his progress and subject him to a destructive fire from the works. Among the artificial obstructions of this class are abatis, chevaux-de-frise, crows' feet, entanglements, fraises, inundations, mines, palisades, stakes, pickets, stockades and trous-de-loup.

Accessory Process. See ANAPOPHYSIS.

Accessory Rays. Twelve small rays lying dorsally and ventrally at the base of the caudal fin of fishes. Dorsal accessory rays are all that are present above the bent-up notochord of a homocercal tail.

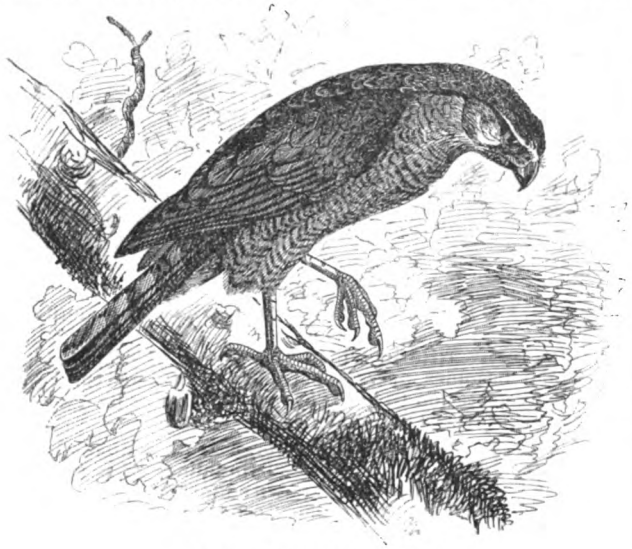
Accident. Event which could not have been avoided by the use of the kind and degree of care necessary to the exigency, and in the circumstances surrounding the parties. For the accidental result of a lawful act there is no legal liability. Court of equity will often grant relief to the victim of an accident, as when a bond or promissory note is lost or destroyed, or when a written contract has been mistakenly drawn or defectively executed. Accident insurance provides indemnity for the loss of life, limb, sight, or time; but not generally for pain, annoyance or grief, as a result of accidental injury to the body of the insured. Terms of a proffered accident policy should be carefully examined by the party about to take it out. In military operations, term applied to an event of secondary importance and which has happened by chance. When applied to the ground over which military operations are conducted, it refers to elevations or depressions which would sensibly affect their successful execution, such as precipitous heights or ravines, streams, forests or other obstacles to unimpeded movements of troops in military formation.

Accidental Variation. See VARIATION.

Accidentals in Music. Symbols occurring outside the

signature, *i.e.*, in the course of a composition, and altering the pitch of the notes before which they are placed. They are the sharp (♯), which raises such a note a semi-tone; the double-sharp (×), which raises the note a whole tone; the flat (♭), which depresses the note a semi-tone; the double-flat (𝄫), which depresses the note a whole tone; and the natural (♮), which cancels the changes effected by the other symbols. There is no uniformity in the use of accidentals in reference to the duration of their validity, though generally their effect is limited to the measures in which they occur.

Accipitridæ (*Falconidæ*). Family of raptatorial birds, having feathered heads, and eyes more or less sunken and furnished with eyebrows. Metatarsus is sometimes feathered. Here belong *Aquila*, the eagle: *Milvus*, the kite; *Buteo*, the



A. nisus, Eur. Sparrow-Hawk.

buzzard; *Astur*, the goshawk, the falcons and harriers. The bald eagle (*Haliaëtus leucocephalus*) has the head, neck and tail white after the third year. It lives on fish robbed from the Osprey.

Accius, or **Attius,** Lucius, ab. 170–86 B.C. Latin tragic poet, praised for vigor and sublimity of thought. He also wrote *Annals* in verse, and several prose works.

Acclimatization. Process of adaptation an organism undergoes to fit it for new conditions of life.

Accolade. Act of salutation which accompanied the bestowing of knighthood; originally an embrace or kiss, later a light blow with the flat of a sword. In French Gothic architecture, the meeting and curving upward at the center of the moldings decorating the edge of a lintel or a flat arch.

Accommodation. Term used in psychology, physiology and opthalmology, to denote the alteration in the eye which is necessary in order that one may see distinctly when one looks from distant to near objects, or the reverse. For distinct vision there must be a sharp image on the retina, and for the normal eye at rest only rays from distant objects are brought to a focus there. When we look at objects near by the rays are brought to a focus by an increase in the curvature of the lens, which is felt to involve an effort. Some eyes cannot accommodate for distant objects, being myopic or short-sighted. Others cannot for near objects, being hypermetropic or far-sighted.—In theology, the exceptionable doctrine that Christian teachers, for essential ends, may speak as if accepting incidental beliefs which they do not hold.

Accommodation Note. Indorsed by one or more parties, given and discounted for money advanced and not for payment of debt.

Accommodation of the Eye. Function or property of the eye by which near and distant objects can be seen clearly. This is accomplished by the contraction or relaxation of a circular muscle (celiary muscle), which lies behind the crystalline lens, thus increasing or decreasing its convexity and accommodating it to near or remote vision. The natural changes which occur as the age increases render the lens less elastic, and its convexity cannot be increased sufficiently to allow of near vision.

Accompaniment, in Music. Speaking generally, all the elements in a composition are subsidiary to the principal part. In primitive music the accompaniment is chiefly rhythmical, hand-clapping or drumming; with the development of the melodic capacity of instruments it becomes melodic and, later, harmonic. In a sense all harmony is an accompaniment to melody. In the European music of to-day, the accompaniment is generally a subsidiary instrumental part, added either to support the principal voice or voices, or to lend fullness, richness or color to a composition. Additional accompaniments are the parts, generally orchestral, contributed by modern musicians to pieces composed at a time when it was customary to leave to the accompanist at the organ or harpsichord the task of filling in harmonic parts contemplated and suggested by the composer but not written down; also to compositions, the original effect of which can no longer be reproduced because of the disuse of certain instruments.

Accomplice. One who is associated with others in the commission of a crime, whether as principal or accessory. A special signification of the term is one who gives evidence against his associates.

Accord and Satisfaction. Agreement whereby the claim of A against B is discharged, upon A's acquisition of a new right against B, or of new rights against B and others, in place of the original claim. If A accepts B's offer to perform something new in satisfaction of an old claim, there is an accord, but there is no satisfaction until full performance is made.

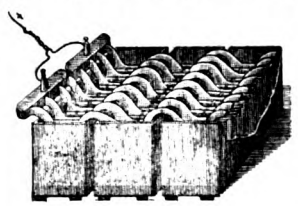
Accordion. Musical instrument, invented in Vienna 1829; a mechanical extension of the principle underlying the mouth-organ. The tones are produced by metallic reeds vibrating freely in a slot and governed by keys placed on one side of a pair of bellows operated by both hands of the performer.

Account. Statement of a fiduciary's receipts and expenses, or of the mutual dealings of merchants. If running or unsettled, it is called an account current; if adjusted and a balance struck, either by express or implied agreement, it is an account stated. The liability to account is sometimes enforced by a common law action, but generally by a suit in equity.

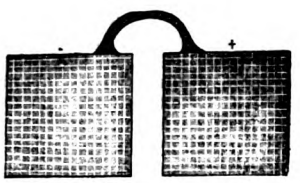
Accretion. Title acquired by the owner of land to the gradual accumulation of soil along a river-bank or seashore.

Accumulation of Wealth. Saving of utilities produced by human effort, distinguished from their consumption or waste by neglect. To this is due all wealth, whether in the improvements of property, money, or human industrial capacities.

Accumulator, Electric. Apparatus for storing electrical energy in the form of potential energy of chemical separation. Plante's consisted essentially of two lead plates immersed in dilute sulphuric acid, the surface of one of these plates being converted into peroxide and that of the other into spongy lead by the action of the current. Faure and Brush modified this by covering both plates with a layer of lead oxide. At present the plates are cast with perforations into which the active material is pressed. If a current be passed through a cell made of such plates the lead oxide on the negative electrode is converted into spongy lead, while



Accumulator with "twin" plates.



"Twin" accumulator plate.

that on the positive electrode is oxidized to lead peroxide. When the two electrodes are joined by a conductor a reverse action takes place and the stored energy again appears in the form of an inverse electric current. A number of such cells joined together is called a "storage" or "secondary battery." The Plante type, modified by greatly increasing the surface of the plate to be corroded, seems to give the best results in practice. An electric condenser such as a Leyden jar is sometimes called an accumulator.

Accumulator, Hydraulic. Cylinder fitted with a piston upon which is a weight. Water is pumped into the cylinder under very great pressure, and the apparatus thus becomes the source of a large amount of potential energy, which may be distributed by pipes for the various operations of hydraulic engineering.

Aceldama ("Field of Blood"). Near Jerusalem; so called as having been bought with the blood-money paid to Judas.

Acenaphthene, or Ethylene-Naphthalene. $C_{12}H_{10}$. Mpt. 95°C. White crystalline solid hydrocarbon found in coal-tar.

It is a combination of ethylene and naphthalene, and is formed by heating them together.

Acephala. Group including those dendrocœlous worms whose anterior end is not specialized into a distinct head. *Polycladus* is an example. The term is also applied to the *Lamellibranchs.*

Acephali (HEADLESS). Epithet applied to bishops or heretics who were under no proper ecclesiastical jurisdiction, or who, as the Eutychians in 452, revolted from it.

Acephalocyst. Sterile cyst of an *Echinococcus* or *Cysticercus* (q.v.).

Acer campestre. Maple tree of family *Aceraceæ*, valuable for timber, shade and ornament. Sap of *Acer saccharum* or sugar maple is source of maple sugar.

Acer campestre.

Aceraceæ. Natural family of trees and shrubs, including all the maples. Commonly known as the Maple Family.

Acerra. In Roman Antiquities, a small box used to hold incense, borne in processions; also a small altar for burning incense beside a dead person before the last rites.

Acestes. Sicilian, son of a river-god and a Trojan, whose arrow was shot with such force as to take fire amid the clouds. *Æneid*, V., 525.

Acetabulum. (1) One of the lobes of the placenta of ruminants. (2) One of the sucking cups of the cuttle-fish. (3) The depression in the epimerum of an insect's segment which receives the coxa of the leg. (4) In anatomy it is the socket of a ball and socket joint, as at the hip.

Acetacetic Ether. $CH_3.CO.CH_2.COOC_2H_5$. Ethyl acetacetate. This salt of acetacetic acid ($CH_3.CO.CH_2.COOH$) is obtained in the form of a sodium compound by the action of sodium upon ethyl acetate. Liquid, much used in syntheses in organic chemistry.

Acetal. $CH_3.CH(OC_2H_5)_2$. Bpt. 104° C. Liquid formed by heating ordinary aldehyde with common alcohol. The term "acetals" is sometimes applied to the class of compounds formed by heating aldehydes and alcohols. These compounds are in reality ethers.

Acetaldehyde. $CH_3.CHO$. Bpt. 21° C. Called also aldehyde and ethyl aldehyde. Liquid formed by the gentle oxidation of ordinary alcohol. It has a characteristic pungent odor and is easily changed to its polymer, para-aldehyde. Found in the first runnings from the alcohol still.

Acetates. Salts of acetic acid.

Acetamide. $C_2H_3O.NH_2$. An ammonia in which one atom of hydrogen has been replaced by an acetyl group. Made by heating ammonium acetate. A white crystalline solid, very weakly basic in character.

Acetanilide, or PHENYLACETAMIDE. $C_6H_5.NH.C_2H_3O$, generally known by the copyrighted name of Antifebrin; produced when aniline and acetic acid are heated together. It is a white, shining, micaceous crystalline powder, used in medicine as an antipyretic in fevers; also in rheumatism, neuralgia and headaches. Dose, 2 to 10 grains. In some cases it has produced faintness, palpitation and cyanosis. Discovered by Gerhardt, 1853, applied by Kussmaul, 1886.

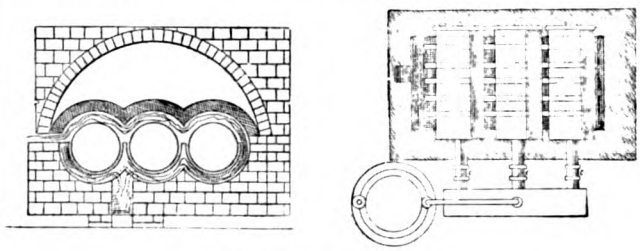
Acetate of Chromium. $Cr_2(C_2H_3O_2)_6$. Found in trade in the form of a green liquor and prepared from chromium hydroxide and acetic acid, or from chrome alum and acetate of lime. Used in textile coloring.

Acetate of Copper. $Cu(C_2H_3O_2)_2$. Dark green crystals containing water; combining readily with arsenic salts of copper to form brilliant greens, as Paris green. See VERDIGRIS.

Acetate of Iron. $Fe(C_2H_3O_2)_2$. The aqueous solution of this salt is known in commerce as "iron liquor," also "black liquor." It is prepared by the action of acetic acid on scrap iron; or, more commonly, from copperas and acetate of lime. Used in dyeing and calico printing.

Acetate of Lead. $Pb(C_2H_3O_2)_2$. Known also as "sugar of lead." White crystals, containing water of crystallization; made by the action of acetic acid upon lead; it is the most important soluble lead salt.

Acetic Acid. CH_3COOH. Bpt. 119° C. The acid of vinegar, and made from alcohol by oxidation; also obtained, together with methyl alcohol and tar, by the dry distillation of wood in iron stills connected with copper condensing worms. The acid is neutralized with lime, forming gray acetate of lime, which is decomposed in bronze stills with sulphuric acid,



Stills for Distilling Wood.

the acetic acid being set free and condensed in a copper worm. 1000 parts of oak wood yield 20 parts of acetic acid. It is largely used in the arts, in the manufacture of white lead, and, in combination with bases, forms acetates; it is also used in medicine.

Acetic Anhydride. $CH_3.CO.O.OC.CH_3$. Bpt. 137° C. A liquid of acid character, equivalent to two molecules of acetic acid less one molecule of water. Forms acetic acid with water. Made by the action of acetyl chloride upon sodium acetate. Used extensively in organic chemistry as a reagent.

Acetic Ether. $CH_3.COOC_2H_5$. Bpt. 75° C. ETHYL ACETATE. Liquid of pleasant odor, produced from ordinary alcohol and acetic acid by means of a water absorbent. Used as a solvent and in the preparation of perfumes and flavors.

Acetines. Compounds produced by the action of glycerine upon acetic acid. Heavy liquids used as solvents for colors in calico printing. See TRI-ACETINE.

Acetoluide. $CH_3.C_6H_4.NH.C_2H_3O$. Known in three forms: para-, meta- and ortho-acetoluide of different molecular forms. The compounds are prepared by heating the toluidines with acetic acid or acetic anhydride.

Acetone. $CH_3.CO.CH_3$. Bpt. 56° C. Dimethyl ketone. Liquid of ethereal odor, present among the products of the dry distillation of wood, but produced usually by heating dry acetate of lime. Used as a solvent and in the manufacture of chloroform.

Aceto-Nitrile. $CH_3.CN$. Methyl cyanide. The nitrile corresponding to acetic acid. Prepared by the action of methyl iodide upon cyanide of potash. Liquid with characteristic odor resembling oil of bitter almonds.

Aceto-Phenone. $C_6H_5.CO.CH_3$. Phenyl-methyl ketone. Liquid of pleasant odor. Easily solidifies. Prepared by heating a mixture of benzoate and acetate of calcium.

Acetoxime. $CH_3C.NOH.CH_3$. White crystalline solid, produced by the action of nitrous acid upon acetone.

Acetyl. $CH_3.CO—$. This group enters into combination with hydroxyl (OH) to form acetic acid, and into a vast number of organic compounds as a constituent.

Acetyl Chloride. $CH_3.COCl$. Combination of the acetyl group with chlorine. Colorless, fuming liquid, changed by water into acetic acid and hydrochloric acid. Prepared by the action of the phosphorus chlorides upon acetates and acetic acid. Very much used for introducing acetyl into compounds.

Acetylene. $CH{:}CH$. Gaseous hydrocarbon formed by the imperfect combustion of illuminating gas. It has an unpleasant, characteristic odor. Combines with chlorine and bromine. The hydrogen can be replaced with certain metals, as copper and silver. These compounds are very explosive.

Acetylene Copper. Dark red powder formed by the union of acetylene with cuprous salts. Very explosive when heated or struck.

Acetylene Series. Series of hydrocarbons in which a triple bonding between carbon atoms is conceived to exist. For example, acetylene HC:CH; allylene CH_3-C:CH.

Achæan League. Coalition at first of four, soon of nearly all the towns in Achaia, ab. 280 B.C., afterward increased by Sicyon, Corinth and others; in 191 B.C. it included Athens and Sparta. It maintained Greek independence against Rome for 50 years preceding the fall of Corinth, 146 B.C.

Achæmenidæ. Family of Persian kings, ruling ab. 730–430 B.C.

Achæta (SIPUNCULOIDEA or INERMES). Gephyrean worms with terminal mouth, dorsal anus, no setæ, and with the anterior region of the body retractile. There is no proboscis, but sometimes (*Sipunculus*) a circle of tentacles about the mouth, and all traces of metamerism is lost. The *Priapulidæ* have no tentacles and the intestine is straight (coiled in *Sipunculidæ*), and there are pharyngeal teeth.

Achaia. District of Peloponnesus, n. of Arcadia and Elis; after 146 B.C. the name of the Roman province including all Greece s. of Thessaly and e. of Ætolia.

Acharius, ERIK, 1757–1819. Swedish lichenologist. *Methodus qua omnes delectos Lichenes*, 1803; *Lichenographia universalis*, 1810; *Synopsis methodica Lichenum*, 1814.

Achates. Friend and companion of ÆNEAS (q.v.). His loyalty to his chief has made *fidus Achates* a synonym for a devoted follower.

Achenbach, ANDREAS, b. 1815. German landscape painter; pupil of the Düsseldorf Academy.

Achenbach, OSWALD, b. 1827. German landscape painter; brother and pupil of ANDREAS.

Acheron. In the lower world, the river of eternal woe, round which the shades hover; sometimes the lower world itself.

Acherusia. Lake in Epirus into which the Acheron flows; also, a cavern in Bithynia, regarded as an entrance to the lower world. Through it Hercules is said to have dragged Cerberus up to the daylight.

Achilles. Chief hero of the Iliad; son of Peleus, king of the Myrmidons, and the Nereid Thetis, who sought to make him immortal by dipping him in the Styx, all but his heel. When nine years old, disguised as a maiden, but detected by Ulysses, he joined the Greek army. He sulked and refused to fight, because Agamemnon took Briseis from him; avenged the death of his friend Patroclus by slaying Hector and dragging his body behind his car; slain at the Scæan gate of Troy.

Achilles Tatius. Rhetorician of 5th century. He wrote the romance of *Cleitophon and Leucippe*, one of the best of Greek love stories.

Achlorophylleæ. Division of the Protophyta, including all the forms in which chlorophyll is wanting and comprising yeast and bacteria.

Achmed III. Sultan of Turkish empire, 1703–30. In a war with Russia, Peter the Great was forced to surrender at Hush, 1711. Morea was recovered 1715, Belgrade lost 1719.

Achmed Pasha. See DJEZZAR.

Achocon. In Peru, a large tree of the Violet Family, *Leonia glycycarpa*, producing a large pulpy edible fruit.

Achromatic Object Glass. One which brings all the rays of light to a common focus. It consists of a combination of two or more lenses made of different kinds of glass, the curves being so adjusted that the dispersion caused by one shall be corrected by the other or others.

Achromatin. Substance occurring in the nucleolus of vegetable cells, which does not stain when treated with ordinary coloring reagents. It constitutes the nuclear sap and the spindle or the reticulum, which is supposed to be metamorphosed into the spindle during cell division.

Achromatism. As all refracting media are also dispersing media, it is clear that images formed by lenses will in general be colored at the edges. Newton supposed that in all cases the amount of dispersion was proportional to that of refraction, and thus that refraction without dispersion was impossible. It was found, however, by Hall in 1733, and subsequently by Dollond, that such is not the case, but that by using two or more optically different media, lens combinations might be constructed which would give achromatic (colorless) images. The principle is now applied to nearly all optical instruments.

Achromatopsy. Affection of the eye which renders us incapable of correctly distinguishing colors. It is commonly known as color-blindness. The commonest form is that of red-blindness, in which case red appears black or bluish green. Dalton was peculiarly afflicted in this regard, and from the fact that he carefully described it the disease is often called "Daltonism."

Achroot. East Indian dye plant, *Morinda tinctoria*, of the natural family Rubiaceæ.

Acid. Substance containing hydrogen which may be replaced, either wholly or in part, by a metal, when the acid is brought in contact with either a metal, a metallic oxide, or a metallic hydroxide. Acids usually possess a corrosive action, a sour taste, and the power to change certain vegetable colors from blue to red. When treated with a base (q.v.) acids form a salt and water.

Acids are divided into two classes: those containing oxygen are called oxy-acids; those containing no oxygen are called hydracids. They are further divided according to the number of replaceable hydrogen atoms which they contain. An acid having one replaceable hydrogen atom is a monobasic acid; for example, HCl. Dibasic acids are those containing two atoms of replaceable hydrogen; as H_2SO_4. Similarly there are tribasic, tetrabasic, pentabasic acids, etc.

If the proportion of oxygen varies, then that one containing the larger proportion of oxygen is given a name ending in ic; to the one having the smaller proportion of oxygen, a name ending in ous. If there is a third, with a still smaller proportion of oxygen, the prefix hypo is used in connection with the descriptive term. Thus the compound H_2SO_4 is called sulphuric acid; H_2SO_3, sulphurous acid; H_2SO_2, hyposulphurous acid. An acid containing the same elements, but a larger proportion of oxygen than H_2SO_4, is designated persulphuric. In designating hydracids the names of the elements in the compound are generally used: thus HCl is either hydrochloric or chlorhydric acid.

An organic acid is a combination of one or more carboxyl (COOH) groups, or one or more acid groupings derived from a mineral acid with any organic grouping, but this union is directly with a carbon atom. Examples: acetic acid, CH_3.COOH., benzene-sulphonic acid, $C_6H_5.SO_2.OH$.

Both mineral and vegetable acids enter largely into human food, usually in combination as salts.

From a medical standpoint these bodies are divided into three classes: one including those whose action depend upon the elements from which they are derived, as, for example, phosphoric acid; another embracing those, such as carbolic acid, which have properties peculiar to themselves; and a third which takes in those used principally as neutralizers of alkalies and as corrosives, and is the class most commonly termed acids. It includes the mineral acids, nitric, muriatic and sulphuric; and the organic acids, acetic, citric and tartaric.

The mineral acids are highly corrosive and are used to destroy unhealthy and morbid growths, while the organic are but feebly so, with the exception of acetic. Both classes when freely diluted relieve thirst, and when taken before eating, increase the acidity of the stomach, but have the opposite effect when taken after meals. When administered in too large quantities and for too long a time, they give rise to a condition resembling scurvy. They have been used to a considerable extent to purify water containing disease germs, especially those of Asiatic cholera, and with considerable success. The salts of the organic acids are as a rule soluble, and when of the alkaline bases render all the fluids of the body alkaline and increase the amount of the urine.

Acidic. When applied to the crystalline rocks, having a large percentage of silica, especially in a free state, as in most granites and gneises.

Acid Aromatic. Combination of carboxyl (—COOH) or the group $HOSO_2$ with a nucleus of carbon atoms combined with each other in a ring form, as in benzene. The acids of the aromatic or benzene hydrocarbons.

Acid Colors. Those capable of fixation upon wool in a bath acidified with sulphuric or acetic acid. As found in trade, they are mainly sodium salts of organic acids or phenols.

Acid, Fatty. Organic acids combined in the ordinary fats. They are monobasic, and those of low molecular weight are liquids, while those of high molecular weight are solids.

Acid Fuchsine. Mixture of the sodium salts of trisulphonic acids, prepared by the action of sulphuric acid upon

para-rosaniline and rosaniline. It dyes wool magenta in an acid bath; known also as acid magenta and fuchsine S.

Acid Green. $C_{37}H_{34}N_2O_{10}S_3Na_2$. Sodium salt of diethyl-dibenzyl-diamido-triphenylcarbinol-trisulphonic acid. Green powder soluble in water; it dyes wool green in an acid bath.

Acid Magenta. See ACID FUCHSINE.

Acid Tartrate of Potassium. See CREAM OF TARTAR.

Acid Violet, 6 B. $C_{31}H_{34}O_4SNa$. Mainly sodium salt of penta-methyl-benzyl-para-rosaniline sulphonic acid, which is prepared from Methyl Violet 6 B by the action of sulphuric acid upon the base. Violet powder.

Acid Yellow S. $C_{10}H_4N_2O_8S\,Na_2$. Sodium salt of the sulpho acid, prepared from dinitro-*a*-naphthol, by the action of sulphuric acid upon it. Orange yellow powder, easily soluble in water; it dyes wool yellow.—Acid Yellow. An impure sodium salt of amido-azo-benzene disulphonic acid. Yellow powder, soluble in water; called also Acid Yellow G. Acid Yellow R is the salt of the corresponding toluene compound.

Acidimetry. Process of determining the strength of a given solution of acid by means of a standard solution of an alkali.

Acidum Phosphoricum Glaciale. See PHOSPHORIC ACID, GLACIAL.

Acinetaria. Class of *Infusoria* including two orders, *Suctoria* and *Non-Suctoria*, according as whether sucking tentacles are present or not. The young are ciliated, while the adults are sessile, and even form stolons that branch, the nucleus passing continuously into all the branches. Spore-fruit is formed at the ends or sides of the branches. *Acineta* is an example.

Acipenser. See CHONDROSTEI.

Acknowledgment. Declaration before an authorized person, by one who has executed an instrument, that it is his deed; also the certificate of this fact. The persons authorized to take acknowledgments, and the forms to be observed, are generally regulated by statute.

Aclidian, or ACLEIDAN. Having no clavicles; *e.g.*, the ungulates and dogs. Cats have rudimentary clavicles.

Aclinic Line. See INCLINATION.

Acmite. Silicate of sodium and iron, named from the pointed form of its crystals; first found in Norway.

Acœla. Same as *Acœlomata:* includes *Sponges* and *Cœlenterata*, these groups lacking a true body cavity distinct from the digestive canal.

Acolyte. Attendant; highest of the four minor orders of R. C. Ch.

Aconcagua. Peak of the Andes, in Chili, highest on the American continent, so far as known. Altitude 23,910 feet.

Acone Eye of Insects. One composed of retinulæ of six visual cells, surrounding a central cell, each containing a rhabdomere.

Aconite. Plants of the genus *Aconitum*, especially *A. napellus* and *A. ferox*, natives of the old world. Known also as Wolf's-bane and Monk's-hood. There is scarcely any drug which is so effective in lowering elevated temperatures of the body as this; but, on account of its depressing action upon the heart, considerable caution is necessary in its use. Both the tuberous root and leaves are used in medicine in cases of rheumatism, neuralgia, etc.

Monk's-hood (*Aconitum napellus*).

Aconitic Acid. $C_3H_3(COOH)_3$. Mpt. 186° C. A tribasic acid found in aconite, sugar cane, beet root and other plants. It is a white crystalline solid, easily soluble in water.

Aconitine. $C_{33}H_{43}NO_{12}$. White crystalline alkaloid of exceedingly poisonons character obtained from the roots of the *Aconitum napellus*. It is prescribed in neuralgia and rheumatism.

Acorn. The one-seeded, dry fruit of the oak.

Acorn Shells. See OPERCULATA.

Acorus Calamus (SWEET FLAG). Genus of aromatic plants, family *Araceæ*.

Acorus Calamus.

Acosta, GABRIEL, or URIEL, 1594–1647. Apostate, of Jewish descent, but educated as a Christian. He went from Portugal to Holland, became a Jew, and for certain heresies was excommunicated by the rabbis.

Acoustics. That branch of physics which treats of the production, transmission and comparison of sounds. See SOUND.

Acrania. Division of *Vertebrata* characterized by the absence of a cranium. A simple brain is present. *Amphioxus* is the only representative. See LEPTOCARDII.

Acraniate. Said of Chordate animals like *Amphioxus*, which lacks a cranium.

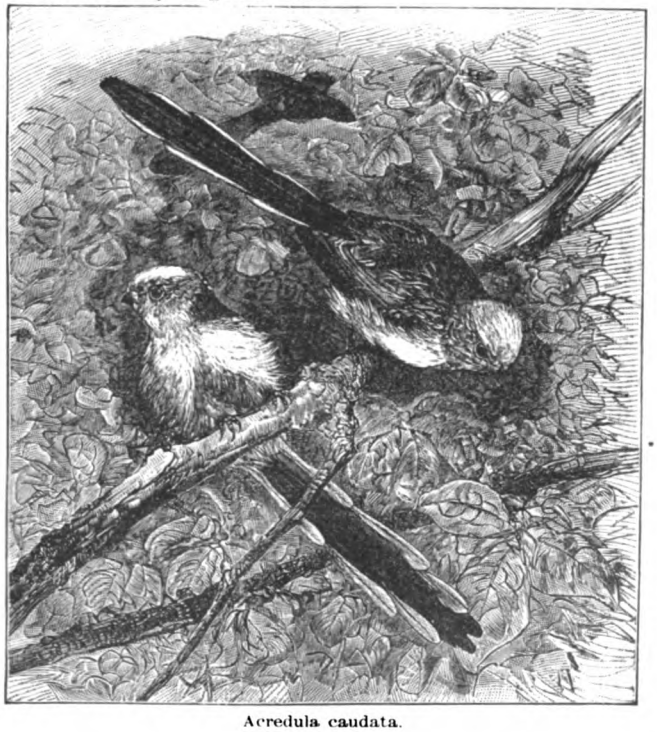
Acrasiaceæ. Family of Myxomycetes or slime-moulds.

Acraspeda, or ACRASPEDOTA. The "covered-eyed" Medusæ include those jelly-fish whose eyes are sunk in special pits in the edge of the umbrella-shaped body. They form the group *Scyphomedusæ*, also sometimes termed *Discomedusæ* and *Lucernarida*.

Acre. Unit of superficial measure of land, 160 sq. rods, or 43,560 sq. ft. A square acre will measure a little less than 209 ft. on each side. The acre of the U. S. is the same as the statute or "English" acre of Great Britain.

Acre, or AKKA. Anciently Ptolemais; important city on coast of Syria, the "key of Palestine," taken by Saracens 638, by Crusaders 1110, retaken by Saladin 1187, recovered by Crusaders 1191, after two years' siege, with loss of 100,000 soldiers, and named St. Jean d'Acre; regained by Saracens 1291, when 60,000 Christians perished; fell into hands of Turks 1517. Bonaparte failed to take it by a two months' siege 1799. Mostly destroyed in siege of nearly six months by Ibrahim Pasha 1831–32; stormed and taken by English Nov. 3, 1840, and handed over to Turks 1841. Pop. ab. 8,000.

Acredula caudata. Genus Titmouse, family Paridæ, characterized by length of tail.



Acredula caudata.

Acridiidæ (GRASSHOPPERS). Saltatorial *Orthoptera*. The posterior pair of legs are very strongly developed. The antennæ are short, the anterior wings are stiff and fold vertically over the membranous wings. The ears are on each side of the metathorax. The chirping sound of these insects is made by the male, by rubbing the femora of the jumping legs against the nervures of the wing covers. They are gregarious and feed on plants.

Acridine. $C_{13}H_9N$. Aromatic base with intensely irritating action upon the mucous membrane. Present in the crude anthracene obtained from coal-tar. Combines with mineral acids.

Acrocarpi. Division of mosses characterized by bearing the sporophyte at the ends of the stem or branches.

Acrocephalus. Reed-warblers, sub-family *Sylviinæ*, char-

Acrocephalus arundinaceus.

acterized by relatively large bill. Found in northern hemisphere; also in India and Australia.

Acrodont. Group of fishes, chiefly Liassic, whose oblong pavement-like teeth contain one single rounded tubercle.

Acrodont Dentition. Teeth on margin of the jaw in Reptiles. Such teeth are not sunk in sockets in the jaw-bone, but stand on the top of its edge.

Acrogens. See PTERIDOPHYTA.

Acroleine. CH_2:CH.CHO. Bpt. 58° C. Acrylic aldehyde; allyl aldehyde. An aldehyde produced by the oxidation of allyl alcohol and in the decomposition by heat of fats and glycerine. A liquid of pungent odor and violent action upon the eyes. The smell of burning fat is due to its presence.

Acrolith. Ancient form of Greek religious statuary, in which the main figure was made of wood, while the hands, arms and feet were of stone. These figures were clothed in garments which were plaited in zigzag folds, and the first entirely stone figures of Greek art show, if draped, an imitation of these zigzag lines. The art of the period which produced these figures was wholly rudimentary and unscientific, the form being no more than a puppet; but such figures of the gods were still venerated in the period of superior art, and the most sacred Athenian statue, an Athene kept in the Erechtheum, was of this class. The famous Panathenaic festival and procession was celebrated in order to give this figure a new garment at stated intervals. The period of the Acroliths must have lasted as late as the seventh century B. C., for stone sculpture of entire figures was certainly not largely practiced before this time. Although there are no remains of such figures, there is a Greek vase in Naples which furnishes a faithful picture of one in its shrine.

Acrophalli. Group of nematode worms in which the male reproductive organ is terminal. It includes *Dochmius*, *Trichina*, *Trichocephalus*, etc.

Acropolis. Citadel hill. Such fortresses were the natural centers of the earliest civilized settlements of Greece and Italy, and in Greece they are especially prominent. On the fortressed hill were built the first and therefore the most sacred shrines and temples of the future city. Here was, in still later days, after the city had grown up around the hill, the place of refuge and the last resort of desperate defense. Especially noted citadels were those of Argos, Mycenæ, Thebes, Corinth and Athens.

Acropolita, GEORGIUS, 1220–1282. Byzantine diplomatist and historical writer.

Acrostichaceæ. Order of Filices, including a great many tropical species.

Acroteria. In classic architecture, pedestals placed at the angles of the pediments of temples for the reception of statues or ornaments of any kind; also the ornaments themselves.

Acrylic Acid. CH_2:CH.COOH. Monobasic, unsaturated acid, combines therefore readily with active chemical agents, forming dibrompropionic acid with bromine. White crystalline solid prepared from acroleine by oxidation.

Acrylic Aldehyde. See ACROLEINE.

Act of War. Act of violence or attack by a main army, equivalent to a declaration of war by the nation sanctioning it, to the rupture of a treaty, or the ending of an armistice.

Acta Consistorii. Edicts of the council of state under the Roman emperors.

Acta Diurna. Species of official gazette issued daily in ancient Rome, which chronicled all important events and the proceedings of the Senate; this last was not usual before Julius Cæsar.

Acta Sanctorum, or ACTA MARTYRUM. By the Bollandist Jesuits: biographies of the saints of the Roman calendar, according to their days; continued for 250 years, still going on. Vol. I. appeared 1643, Vol. LXV. 1892.

Actæon. Huntsman who, because he once saw Artemis (Diana) bathing, was changed by her into a stag, and torn in pieces by his own dogs.

Actheres. See SIPHONOSTOMATA.

Actian Games. Celebrated at Actium, in honor of Apollo; revived by Augustus to commemorate his victory there.

Actinal Surface. Region which bears the mouth in Echinoderms. In star-fishes it is the flat side, that on which the animal crawls. Also called the ambulacral surface.

Actinaria. Group of *Zoantharia*, which includes the *Actinia* (sea anemone). It secretes no hard parts. See MALACODERMATA.

Actinic Rays. See RADIATION.

Actinidæ. Family of Actinarian corals, including *Actinia* the sea anemone. This is a sack or cylinder-shaped organism composed of soft, often brightly colored, tissues. It is fastened by one end to some object and on the other bears a crown of tentacles that, when expanded, resemble the corolla of a flower. In the center is the mouth, with a short œsophagus leading into a space that communicates in all radii with the spaces between the mesenteries. The latter are vertical partitions that project from the body wall toward the center.

Actinism. See RADIATION.

Actinocrinus. Genus of Carboniferous Crinoids, or Stone Lilies, the plates of which are embossed with radiating star-like ridges and the stems of which usually had projecting spine-like branches.

Actinolite. (Ca, Mg, Fe) Si O_3. Natural silicate of magnesium, calcium and iron, usually fibrous or in bladed crystals, and bright green or grayish green in color; one of the varieties of Amphibole.

Actinometer. Instrument for measuring the power of the sun's rays. Various forms have been devised, depending commonly upon the time required to heat a definite quantity of water, when exposed to the direct action of the sun. See PYRHELIOMETER.

Actinomyces bovis.

Actinomyces bovis. Ray fungus. The disease actinomycosis, lumpy jaw, is caused by this fungus. It is a chronic and usually fatal disease of cattle, communicable to man, characterized by the formation of large tumors in the jaws.

Actinophrys. See HELIOZOA.

Actinopteri. Fishes with well-marked rays in their fins, as in Teleosts and some Ganoids.

Actinosoma. Entire organism or body of a coral colony.

Actinosphærium. See HELIOZOA.

Actinotrocha. Larva of the Gephyrean worm *Phoronis*. It has a circle of ciliated tentacles around the anterior end, be-

hind the præoral lobe and the mouth. The body is ciliated in general; but a special circle of cilia stands on the margin of the præoral lobe in front of the mouth, and another circle surrounds the anus. A ganglion, and sometimes eyes, are present in the præoral lobe.

Actinula. Larval polyp, into which the eggs of certain jelly-fish develop.

Actinum. New metal found 1881 by Phipson accompanying certain zinc ores. It has not been generally recognized as a true element.

Action. Judicial proceeding for the enforcement of a private right, redress of a private wrong, or punishment of a public offense. Actions which must be brought within a particular jurisdiction, such as those for injuries to real estate, are called local; others are transitory. The tendency of modern legislation is to abolish the various forms of action recognized by the common law, as well as the distinction between actions at law and suits in equity, and to establish but a single form of action for all legal proceedings.

Action and Reaction. Newton used the word action as synonymous with force or pressure. When a body is in equilibrium, under applied and resisting forces, the applied forces in any direction constitute the action, which is equal and opposite to the resisting forces in the opposite direction, or the reaction.

Actium. Now La Punta; promontory in Acarnania, W. Greece, off which Augustus won his famous naval victory over Antony and Cleopatra, 31 B.C.

Activity. Power or rate of doing work. The units of activity are the same as those of power; viz., the horse-power, cheval-vapeur, and the watt. The dimensions of activity are $[M]\,[L]^2\,[T]^{-3}$.

Acton, Lord John Emerich Edward Dalberg, D.C.L., b. 1834. English peer 1869, leader of liberal Catholics.

Acts of the Apostles. Fifth N. T. book, written by St. Luke, companion of Paul, and author of the third Gospel, of which it may be called the second part; confined principally to the acts of SS. Peter and Paul.

Acts of Uniformity. Passed in Parliament 1549, confirmed 1552, repealed by Mary 1554, and re-enacted by Elizabeth 1559, imposing fine and imprisonment on those who refused to use a certain order of worship. The act passed in 1662 obliged all clergy to subscribe to the 39 articles and use the Book of Common Prayer. Its enforcement, August 24, "Black Bartholomew's day," caused more than 2,000 ministers to quit the Church of England. An amendment act, authorizing shorter services and other changes, was passed July 18, 1872.

Aculeata. Sub-order of *Hymenoptera* having retractile stings in the female sex, and also poison glands. The abdomen is always stalked; the antennæ of the male are thirteen jointed, and of the female, twelve-jointed. The larvæ are without anus or feet. The chief families are *Formicidæ* (ants), *Fossoria* (digging-wasps), *Vespidæ* (wasps), and *Apidæ* (bees) (q.v.).

Aculeus. Sting of insects. It develops from a double pair of projections of the next to the last segment of the abdomen, and one pair from the antepenultimate segment. The last furnishes the piercing parts, the former the sheath.

Acupressure. Control of bleeding from small blood-vessels by passing a pin or needle through the tissues beneath them, the elasticity of the pin compressing the vessel. Where this is not sufficient, a thread is twisted about the pin like a rope upon a cleat. It has been practiced by the Chinese from time immemorial.

Acupuncturation, or Acupuncture. Puncture of the skin by a number of closely set needles, as a counterirritant in pain, or as a method of introducing certain drugs into the system, which are rubbed over the punctures or applied to the needles beforehand.

Adam. Progenitor of the human race; whether historical or typical is a disputed point of modern controversy. The name signifies simply man.

Adam, Adolphe Charles, 1803–1856. French composer; most successful in the field of comic opera, in which his masterpiece, *Le Postillon de Longjumeau*, 1835, takes high rank; pupil of Boieldieu, for whose *La Dame blanche* he wrote the overture. Member of the Institute 1844, prof. at Paris Conservatoire 1849. His other operas are *Pierre et Cathérine*, 1829; *Danilowa*, 1830; *Le Châlet*, 1834; *Le Brasseur de Preston*, 1838; *Le Roi d'Yvetot*, 1842; *Cagliostro*, 1844; *Richard en Palestine*, 1844. Ballets: *Faust*, 1832; *La jolie Fille de Gand*, 1839; *Giselle*, 1841.

Adam, Juliet (Lamber). Mme. Edmond, b. 1836. French author; founder of the *Nouvelle Revue*, and its editor 1879–86. *Siege of Paris*, 1873.

Adam, Robert, 1728–1792. Scotch architect. With his brother James, d. 1794, he planned great part of west end of London, public buildings in London, Edinburgh, and Glasgow, and many country seats of the nobility.

Adam de la Halle, ab. 1240–1286. French trouvère, notable in the history of dramatic music as both poet and composer, and one of the earliest practitioners of harmony. His *Jus de Robin et Marion* is called the first French comic opera.

Adam of Bremen. Author, ab. 1075, of a history of missions in Scandinavia, with a description of those countries.

Adam of St. Victor, ab. 1110–1172 or 1192. Greatest Latin poet of the Middle Ages, called by Dr. J. M. Neale "my dear and reverend master." His works, tr. by Digby S. Wrangham, 1881, fill 3 vols.

Adam-and-Eve. American orchid, *Aplectrum spicatum*, native of the e. U. S.; called also Putty-root.

Adambulacral Plates, or Ossicles. Large special plates, situated on the margins of the rays of certain starfishes, next to the outer ends of the ambulacral ossicles.

Adams, Charles Francis, LL.D., 1807–1886. American statesman, son of John Quincy; Free Soil candidate for Vice-President 1848; M. C. 1858–61; minister to England 1861–68; arbitrator of Alabama claims 1871.

Adams, Charles Kendall, LL.D., b. 1835. American educator and author; prof. Univ. Michigan 1863–85; pres. Cornell 1885–92, and since of Univ. Wisconsin; chief editor of *Johnson's Cyclopædia*, 1892. *Democracy and Monarchy in France*, 1872; *Columbus*, 1892.

Adams, Edwin, 1834–1877. American actor.

Adams, Hannah, 1755–1832. American author. *View of Religions*, 1784; *History of New England*, 1799.

Adams, Henry, b. 1838. American historian; son of Charles F. *Life of Gallatin*, 1879; *Life of Randolph*, 1882; *History of the United States*, 1801–17, 9 vols., 1889–91.

Adams, John, 1735–1826. Second Pres. U. S. He represented Mass. in Colonial Congress 1774; was a member of committee which framed Declaration of Independence; Commissioner to France 1777, plenipotentiary to treat for peace with Great Britain 1779, Minister to England 1785–87; Vice-Pres. U. S. 1789; Pres. 1797–1801; defeated for a second term by Jefferson.

Adams, John Couch, 1819–1892. Prof. Univ. Cambridge and Director of the Observatory from 1861; known for researches in the lunar theory, investigation of the perturbations of Uranus, and prediction of position of Neptune, Oct. 1845, nearly a year before Leverrier's announcement led to its discovery at Berlin.

Adams, John Quincy, 1767–1848; son of Pres. John; sixth Pres. U. S. U. S. Senator from Mass. 1803; Minister to Russia 1809; Sec. of State 1817; Pres. 1825–29. He was in Congress from 1831, and earned fame as defender of the right of petition. He wrote several volumes of prose and one of verse.

Adams, Julius Walker, b. 1812. Civil engineer; designer of water-works and sewers in Brooklyn, New Haven, and other cities; Pres. Am. Society of Civil Engineers 1874.

Adams, Samuel, 1722–1803. Patriot of the American revolution; one of the most earnest and efficient advocates of the cause of the colonists; delegate to Continental Congress 1774; signer of the Declaration of Independence 1776; M. C. till 1781; Lieut.-Gov. of Mass. 1789–94; Gov. 1794–97.

Adams, Mrs. Sarah Fuller (Flower), 1805–1848. English poet, author of "Nearer, my God, to Thee."

Adams, William, 1814–1848. Anglican divine. His *Sacred Allegories*, 1842 and later, were long popular and useful.

Adams, William, D.D., LL.D., 1807–1880. Presbyterian pastor in New York 1834–73; pres. Union Theol. Sem. from 1873.

Yucca filamentosa.

Adams, WILLIAM, D.D., b. 1813. American divine, of Irish birth; prof. in Nashotah (Wis.) Theol. Sem., since 1841.

Adams, WILLIAM HENRY DAVENPORT, b. 1828. English author; ed. *Scottish Guardian*, 1870–77. He and his son, WM. DAVENPORT, have produced over 100 volumes.

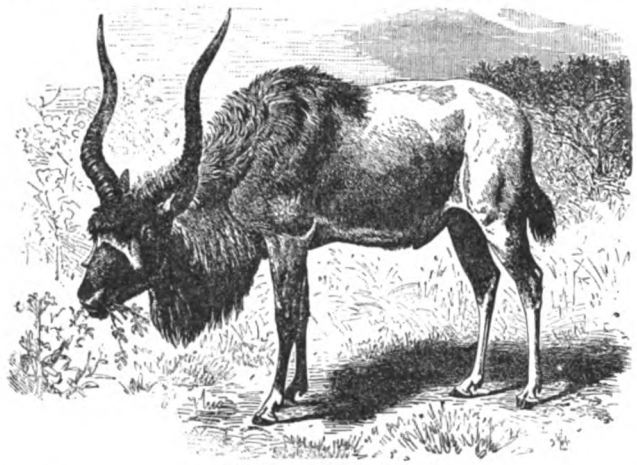
Adams, WILLIAM TAYLOR ("OLIVER OPTIC"), b. 1822. American author of many juvenile stories.

Adam's Needle. *Yucca filamentosa*, a narrow, rigid-leaved herb of the natural family *Liliaceæ*, with showy white flowers; native of the s. e. U. S.

Adanson, MICHEL, 1727–1806. French botanist, author of *Histoire naturelle du Senegal*, 1757; *Familles des plants*, 1763.

Adda. River in N. Italy, near which Suwarrow defeated the French, April 27, 1799.

Addax nasomaculatus. African antelope, family *Bovidæ*, sub-family *Antilopinæ*. Body ab. 3 ft. high, yellowish



Addax nasomaculatus.

white, except the head, which is brown, with a white blaze on the face. The horns are spirals with two or three twists.

Addendum Circle. In toothed gearing, circle which limits the projection of the teeth beyond the pitch circle of the wheel. Usual values for difference between the pitch radius and addendum radius range from .30 to .35 of the circular pitch. In formulæ based on the diametral pitch, the value is unity divided by the diametral pitch.

Adders. See SOLENOGLYPHA and VIPERS.

Adder's-mouth. Orchids of the genus *Achroanthes*.

Adder's-tongue. Early spring flower, *Erythronium Americanum*, erroneously called "yellow violet" and "dog's-tooth violet." Also, fern-like plants of the genus *Ophioglossum*.

Addison, JOSEPH, 1672–1719. English essayist and poet. Under-Secretary of State 1706; M.P. 1708; Secretary of State 1717–18. His works include many political papers, the once famous tragedy of *Cato*, 1713, a few fine hymns, and *Dialogues on Ancient Medals;* but his chief services to literature were rendered through *The Spectator* (q.v.), which he established in 1711, and the best parts of which he wrote. He did much to purify English prose, and was the model of style for a century.

Addison's Disease. First described 1855 by Dr. Addison of Guy's Hospital, London. The most marked symptom is a bronzing of the skin. It usually occurs in adults, and is more common in men than in women. Progressive wasting, great weakness, feeble action of the heart, disordered digestion, pain in the joints, and consumption, lead speedily to a fatal termination. A diseased condition of the suprarenal capsules is the only peculiar morbid appearance found after death. Treatment is of little avail, but life may be prolonged and rendered more comfortable by the use of cod liver oil, phosphites, calcium chloride, and arsenic.

Addition. Aggregation of several quantities in one expression called the sum. Arithmetical addition requires quantities to be of the same kind. Algebraic addition aggregates unlike quantities by the use of the signs plus (+) and minus (−).

Adeciduata. Section of the *Eutheria* or placental mammals, in which no decidua or "after-birth" is shed, following the birth of the young. The following orders are included: *Edentata*, *Sirenia*, *Cetacea* and a portion of the *Ungulata*, such as most *Perissodactyla* and *Artiodactyla* and the *Toxodontia*. See DIPLARTHRA.

Adelaide. Capital of South Australia, settled 1836. It has two colleges, a theol. sem., and a large botanic garden. Pop., 1891, 133,220.

Adelarthrosomata. PHALANGIÆ, PSEUDOSCORPIONIDÆ, and SOLPUGIDÆ.

Adelbert College. Founded at Hudson, Ohio, 1826, as Western Reserve College; transferred to Cleveland 1882, receiving from Amasa Stone an endowment of $450,000 and $150,000 in buildings. It has 11 professors, 5 instructors, a library of 25,000 vols., a fund of $700,000, and forms a department of Western Reserve University.

Adelheid, 931–999. German empress, mother of Otho II.; imprisoned by Berengar II.; escaped to Canossa, and was besieged there. Otho I. came to her relief 951, and married her at Pavia.

Adelocodonic gonophores. Buds, on a hydroid colony, which produce eggs, and which, in the distant ancestors, were in the habit of developing an evident medusoid structure, but now are so much reduced that even a true umbrella fails of development.

Adelung, JOHANN CHRISTOPH, 1732–1806. German philologist, who devoted much labor and ability to the improvement of his native tongue, but was overshadowed by the success of the great scholars, like Jacob Grimm, who followed him. Besides minor works on philology, he wrote a German Dictionary, 1774–86, and *Mithridates*, which foreshadowed results in comparative philology.

Aden. Town on s. w. coast of Arabia; seized by the British Jan. 19, 1839. Pop. ab. 42,000, chiefly Mohammedan.

Aden, GULF OF. Arm of the Indian Ocean, between Abyssinia and Arabia, into which the Red Sea opens by the Strait of Babel Mandeb.

Adenitis. Inflammation of the lymphatic glands, resulting in a painful and hard swelling, easily moved around by the fingers, which may disappear spontaneously or be converted into an abscess. It may be caused by injury, the absorption of poison from snake-bites, etc., unhealthy wounds, gonorrhœa, etc., or occur as a symptom of tuberculosis or scrofula. Rest of the parts, poulticing, painting the surface over the glands with iodine, evacuation of pus when it forms, and the removal of the glands, are the proper remedial measures, combined with cod liver oil and the hypophosphites.

Adenoid Tumor. Non-malignant, seated in a gland, or in structure resembling that of the secreting glands. Removal by an operation is usually necessary, but as a rule free from danger.

Adenophore. Stalk on which the glands of certain plants are borne, especially those of the nectar-glands of flowers.

Adhamantes. Birds having walking legs with four toes all directed forward; sometimes the inner toe can be turned back.

Adhémar, JOSEPH ALFONSE, 1797–1862. French mathematician; early theorist on possible cosmical causes for the glacial era. In his *Révolutions de la Mer*, 1842, he speculates on the effects of a supposed unequal distribution of heat, the existence of enormous polar ice-caps and their rapid disappearance with the accompanying results upon the earth's center of gravity. Hence he imagined periodical and violent deluges occurring every 10,000 years, and causing world-wide devastation. His views, much modified, form the basis of Croll's Eccentricity Theory.

Adhesion. Attraction of two polished surfaces of solids in contact, of a liquid and a solid, or of a gas and a solid. Capillarity of tubes is due to this.

Adhesion Car. Railway car with special wheels which gripe a rail and thus secure extra adhesion to prevent it from sliding down steep grades. A cable car with wheels griping a moving cable is another instance of the application of the principle.

Adhesion of Cement. Neat hydraulic cement adheres to brick with a force of ab. 200 lbs. per sq. inch of surface. The adhesive force increases with the age of the cement, particularly during the first year. Brick should be wet when the cement is applied, in order to secure satisfactory adhesion.

Adhesion of Locomotives. Frictional force between the driving wheels of a locomotive and the rail is often called adhesion. Its value is usually about one-fourth of the weight

borne by the driving wheels; that is, if the horizontal resistance exceeds this amount the wheels will slip on the rails.

Adhesive Plaster. Cloth or some other material on one side of which is spread an adhesive substance rendered soft by heat. Lead plaster, resin and india rubber are used. It should be kept in a cool place until wanted, and when used may be heated by passing it through a flame, or by applying the plain side to a vessel containing hot water. Soaking in or sponging with warm water will render its removal easy and painless, and all surfaces to which it is applied must be perfectly dry.

Adiabatic. If the physical state of a body, as defined by its volume v and pressure p, varies in such a way that no heat is imparted to or taken from the body, it is said to suffer an adiabatic change.

Adiabatic Curve. Representing the relations of pressure and volume in a gas undergoing expansion or compression in a closed envelope. The ordinates show the pressures when no additional heat is transferred from or to the containing vessel, but where all the heat which is converted into work is withdrawn from the gas itself, in expanding, or when the heat which results from compression is all received by the gas itself. The equation of the curve is $p\,v^k = p_1\,v_1^k$ = a constant for any gas, and for dry steam $K = 1.135$; while for air, $K = 1.41$.

Adiantum pedatum (MAIDEN HAIR). N. American ferns,

Adiantum pedatum (Maiden Hair).

widely distributed. The name Maiden Hair is also applied to other species of the genus.

Adiathermanous. See DIATHERMANOUS.

Adinida. Order of *Cilioflagellata*, with cuticular shell, compressed laterally, and with a flagellum at the anterior pole and no transverse groove.

Adipocerite. Mineral hydrocarbon, allied to paraffin; sometimes called mountain tallow; hatchettite.

Adipose Tissue. Network of fibrous tissue, in the meshes of which are numerous globules of fat.

Adirondack Mountains. Group in northern N. Y. The highest summit is Mt. Marcy or Tahawus, 5379 feet in altitude; some ten others are little less. The region abounds in lakes and in noble scenery, and receives thousands of summer visitors. By a law passed 1892, over 2,800,000 acres in Hamilton, Essex, Warren, Franklin and St. Lawrence counties, part being public lands, the rest intended to be purchased, were designated as a public park.

Adit. In mining, a passage horizontal, or with a slight upward inclination, by which a mine is entered, and through which the water in the upper workings and that raised from the deeper parts of the mine may be discharged. Adits are frequently driven through the country rock at large angles with the strike of a mineral deposit; when following the strike they are called adit-levels. In the U. S. commonly called tunnels. Among famous mining adits are the Sutro tunnel in Nevada, the Deep George and the Ernst August adits in the Hartz Mountains, and the Rothschönberger adit in Saxony. The last was opened for use in 1877; with its proposed branches it will be nearly 32 m. long.

Adjustable Cut-off Engine. One in which the degree of the expansive working of the steam in the cylinder can be varied while the engine is running, by adjusting the point at which the supply of live steam from the boiler shall be "cut-off" by the valve gear. This is done by varying the lap, the lead or the travel of the admission valves, or, in drop cut-offs, by altering the point when the steam valves are released. (See AUTOMATIC CUT-OFF.) The advantages of controlling the power of an engine by this means, instead of using a throttling valve in the supply pipe, are that steam reaches the engine more nearly at boiler pressure and temperature, and the theoretical advantages are attained from working the steam expansively within the practical limits. The steam enters the cylinder at a higher pressure, and leaves it at a lower, and the efficiency of an expanding vapor is proportional to the difference between the initial and final temperatures (absolute) divided by the initial temperature. The temperatures of course correspond with the pressures.

Adjustment of Observations. Process of correcting observed quantities so as to obtain the most probable values. As the simplest instance, the most probable value of a single quantity measured several times with equal care is the arithmetical mean of the observed values. The rules for adjusting observations are deduced by a branch of analysis called the method of least squares.

Adjutant. In the U. S. service, an officer selected by a regimental commander from his subalterns, to hold office for four years. He has charge of the various rosters of service; makes, publishes and verifies all details; keeps the records of the regiment, performs such military duty with troops as are required by tactics and regulations, and is the colonel's medium of communication with his officers and men.

Adjutant-General. Officer who communicates to the troops all general orders which emanate from the War Department or headquarters, as well as the orders of detail, of instruction, of movement, and all general regulations for the army.

Adjutant-General's Department. It is charged with the records of all military appointments, promotions, resignations, deaths and other casualties, the registry of all commissioned officers, the filling up and distribution of their commissions, and the preparation and issue of the yearly army Register. It is the repository for the records of the War Department, which relate to the personnel of the military establishment and the military history of every commissioned officer and soldier of the regular and volunteer forces in the service of the United States. It also has charge of the recruiting service and the general returns of the army.

Adler, FELIX, Ph.D., b. 1851 in Germany. American reformer, of Jewish birth; prof. in Cornell 1874–76; founder in 1876 of the Society for Ethical Culture, New York. *Creed and Deed*, 1877.

Admetus. King of Pheræ, in Thessaly; married ALCESTIS (q. v.). Apollo attended his flocks 9 years, and promised him exemption from death if father, mother or wife would die for him.

Administration. Legal management by the administrator or executor of the personal estate of the intestate or testator. Formerly it was under the control of ecclesiastical courts in England, but now, as in the U. S., it is within the jurisdiction of probate courts, which in some States are called orphans' courts, in others, surrogates' courts. The persons entitled to administer upon the estate of an intestate, and their powers and duties are generally defined by statute.

Administration, ARMY. (1) Recruiting service and custody of records and returns of personnel; (2) administrative service of engineers; (3–6) ordnance, quartermaster's, subsistence, and pay departments; (7) administrative service of the medical department; (8) settlement of army accounts. Their operations should be so regulated that the Sec. of War will be always informed of the condition of each, and able to exercise, subordinate to law, a complete financial control over them.

Administration, COUNCIL OF. Board of officers assembled to audit the funds of posts, canteens, and companies; to ascertain and examine the sources from which, and the methods by which, they have accrued; and to recommend expenditures therefrom.

Administrative Unit. Subdivision of the larger units of an army for the purpose of administering its affairs in accordance with law. Thus the regiment is the administrative unit in all armies, the center for instruction and recruiting, and the unit dealt with in historical and other records.

Admiralty. Court having cognizance of maritime causes. In England it dates from the time of Edward III., but its jurisdiction has been extended by modern statutes. By the U. S. Constitution admiralty jurisdiction is vested exclusively in the federal courts, and extends to all navigable waters of the

U. S. Admiralty procedure is based upon the Roman rather than the common law.

Admiralty Island. In s. e. Alaska; 90 m. long by 25 broad. Its shores are high and precipitous.

Admiralty Islands. Group of ab. 40, in the Pacific Ocean, n. e. of New Guinea.

Admissions. Statements by or on behalf of any party to a legal proceeding, suggesting an inference as to any fact in issue or relevant thereto. They are received as evidence against, but not in favor of, the person responsible for them.

Adnation. Union of parts of flowers in different circles, as of stamens with petals.

Adobe. Bricks dried by the sun, and unburned; made in Egypt, China, and some parts of America; usually larger than ordinary bricks, and inferior in strength and hardness. The material is two-thirds fine sand and one-third clay.

Adolf of Nassau. German emperor, 1291–1298; a poor count of low character, elected by the Papal party on the death of Rudolf I.

Adolphus, JOHN. 1768–1845. English lawyer. *History of England from 1760*, 1802–45.

Adonijah. Fourth son of David, pretender to the throne; first forgiven by Solomon, but, giving new ground of suspicion, was put to death.

Adonis. Young shepherd and huntsman, favorite of Venus, slain by a wild boar.—Genus of plants of the family *Ranunculaceæ*.

Adoption. Institution of the legal relation of parent and child. The civil law recognized the practice, but it is the creature of statute in common-law countries.

Adoptionism. Doctrine of Elipandus, Abp. of Toledo, ab. 800, that Christ, as to His Godhead, is Son by nature, but as to His manhood, by adoption; ecclesiastically condemned.

Adoration of the Lamb. Most celebrated picture of the 15th century, by Hubert and Jan Van Eyck; painted as an altar piece ab. 1420, for a church in Ghent, where the central portions are still to be seen. These were originally connected

with wings folding over the central subjects, and having paintings on both sides, so that, whether the wings were open or shut, paintings were visible. Six of these outer panels are in the Berlin Museum, and two others at Brussels.

Adrastea, or ADRASTEIA. Daughter of Jupiter and Necessity; goddess of retribution. A synonym of NEMESIS (q.v.).

Adrenals. Remnants of the mesonephros, lying in front of or alongside the kidneys.

Adrian. See HADRIAN.

Adrian, ROBERT, 1775–1843. Prof. Rutgers Coll., N. J., Columbia Coll., and Univ. Pa.; ed. Hutton's *Mathematics*, 1818.

Adrianople. Most important city of European Turkey, after Constantinople; founded and restored by Hadrian. Near it Constantine defeated Licinius and gained the Empire 323, and Valens was defeated by Goths 378. It was taken by Turks 1361, and was their capital till 1453. Russians took it Aug. 20, 1829, Jan. 20, 1878. Pop. ab. 100,000.

Adrianople, PEACE OF. Sept. 19, 1829. It concluded the Russo-Turkish war; gave Russia coast of Black Sea, from mouth of Kuban to harbor of St. Nicholas, also the Caucasus, and part of Alkalzik; left Turkey in possession of Wallachia, Moldavia, and Russian conquests in Bulgaria and Roumelia.

Adriatic Sea. Arm of the Mediterranean, e. of Italy.

Adular, or ADULARIA. $K_2Al_2Si_6O_{16}$. Transparent, cleavable variety of orthoclase; named from Adular Mts. in the Swiss Alps. See MOONSTONE.

Adullam. Cavern in the wilderness of Judah, to which those discontented with the government of Saul resorted and banded together under his competitor David. I Sam. xxii. 1, 2.

Adulteration. Mixture of inferior material, or application of less labor than the asserted grade of the goods supposes. The large number of intermediaries between producer and consumer in modern industry seems favorable to adulteration; this has led some to group manufactures subject to adulteration with natural monopolies as proper subjects of state administration.

Adultery. Sexual intercourse between a man and another's wife, endangering the husband with spurious offspring. It is not a common-law crime, but is punished as an offense by the statutes of many States.

Advance-note. Draft on the owner or agent of a vessel, generally for one month's wages; given by a master to a sailor at the time of his signing the articles of agreement describing the terms of service.

Advanced Covered Way. Passage-way for troops, sometimes constructed beyond the main glacis. On the side toward the enemy it is covered from his view by an interior slope and exterior glacis, both swept by the fire of the main work.

Advanced or **Detached Works.** Separated from the main work, but having such defensive relations with it as to render it more secure. They are commanded by the fire of the main work, their gorges can be swept by it, and their positions are determined so as to prevent by their cross or direct fire any penetration between them until after their capture.

Advancement. Transfer of property by parent to child in anticipation of the child's share of the parent's estate. It differs from a gift in that it is to be deducted from the child's share, and from a debt in that it does not subject the child to an action for its recovery. Its doctrines rest on the statute of distributions.

Advent. Season of Ch. Year preceding Christmas, dedicated to the consideration of our Lord's coming. It begins with the Sunday nearest to St. Andrew's Day, Nov. 30.

Adventists. Those Christians who, regarding the second coming of Christ as imminent, have organized on that basis. The most active denomination of these is the Seventh Day Adventists, formed 1845 with headquarters at Battle Creek, Mich.

Adverbs. Indeclinable words, sometimes called particles, which modify a verb, adjective, or other adverb. In English they are either formed from adjectives by the addition of *ly* (like), or else are fossilized inflected forms, as *while* (really the accusative case of the noun *while* = time), *seldom* (a dative plural), and many others.

Adverse Possession. Exclusive, actual, continued possession, under a colorable claim of title, or accompanied by actual occupancy of the land. The adverse possessor has title as against every one but the true owner, and as against the latter upon the expiration of the period fixed by statute, generally twenty years.

Advocatus Diaboli. Roman official, appointed to argue against a proposed canonization, as the *Advocatus Dei* to urge the reasons for it.

Advowson. Right of presentation to a church living in England; heritable and transferable.

Adynamic Leads. Wires which conduct the current to a galvanometer or other apparatus, when twisted in such a way that the resultant inductive effect upon the sensitive parts of the instrument is zero.

Adytum. Secret chamber in a temple, from which all but the officiating priests were excluded; attached only to temples in which oracles were uttered.

Æcidiomycetes. Sub-class of Fungi, comprising an immense number of minute forms, parasitic on other plants.

Æcidiospores. Spores produced in the *Æcidium* state of Fungi of the class *Uredineæ*.

Ædicule. Small shrine or tabernacle, a canopy with columnar supports, in appearance like a temple, under which the statue of the deity was placed; any small shrine, whether of stone or other material. Pictures of columnar ædicules are frequent in ancient art.

Ædile. Annual magistrate in ancient Rome, having charge of public works and buildings, also of markets and police duties.

Ædœology. Science of generation and the generative organs.

Ædogoniaceæ. Order of small fresh-water Algæ, very common in pools and streams.

Ægates Islands. W. of Sicily; here the Carthaginian fleet was vanquished by the Roman, Mar. 10, 241 B.C. Rome obtained Sicily and 3,200 talents as tribute-money.

Ægean Sea. Grecian Archipelago; part of the Mediterranean between Greece and Asia Minor.

Ægidius, St., or ST. GILES, ab. 640–720. Monk of Greek birth; founder of a monastery near Nimes, ab. 673; patron of cripples. His day is Sept. 1.

Ægidius Colonna, 1247–1316. Italian schoolman, "Doctor Beatus"; Abp. of Bourges 1296.

Ægina. Island s. w. from Athens. The Argive Pheidon was said to have established a silver mint here ab. 862 B.C. Its inhabitants were expelled by the Athenians 429 B.C.

Æginidæ. Family of *Trachymedusæ*, with flat discoidal umbrellas, whose digestive cavity has large flat pouches instead of radial canals; the circular canal is solid. The genital lamellæ lie in the radii of the manubrium.

Ægis. Brazen shield of Jupiter, made by Vulcan; symbolical of divine protection. Minerva also had one, in the center

Minerva, from statue in the Villa Albani, Rome.

of which was the head of the Gorgon Medusa. In art representations, the Ægis is the breast-armor or corselet of the goddess, is covered with scales or plates, and bears the Gorgon's head.

Ægithognathæ. Birds whose maxillo-palatines are separated by a cleft, and not united to the vomer, which is truncated in front and narrow behind, as in the Perchers, Swifts and Woodpeckers.

Ægospotamos. River and town in Thracian Chersonese, scene of Lysander's victory over Athenians 405 B.C.

Ælfric. Anglo-Saxon theological and grammatical writer of tenth century.

Ælia Capitolina. Name of Jerusalem from its rebuilding by Hadrian, 130, till ab. 325.

Ælianus, CLAUDIUS. Roman rhetorician under Hadrian, 117–138. Two considerable works extant; *Varia Historia*, a miscellaneous history, and *De Animalium Natura*, on the peculiarities of animals. Twenty letters on husbandry are also attributed to him.

Æluridæ. Family of *Arctoidea*, including the Wah or Panda of India and Thibet, a cat-like animal, but with larger ears, and a long tail heavily furred. It is fawn-colored above and black beneath, with yellow bands around the tail; there is some white on the face, and the pelage has a satiny luster. It walks plantigrade, and resembles a bear in structure, but it runs like a weasel. An allied genus (*Ailuropus*) discovered in Thibet 1874 is white, like a Polar-bear.

Æluroidea (EPIMYCTERI). Section of FISSIPEDE CARNIVORA, characterized by digitigrade progression and possession of a tympanic bulla divided into two chambers, the outer one being the true tympanic chamber. The carnassials are well developed, and the toes are retractile (except in *Hyæna*). Usually only one molar exists on each side of each jaw. Families included: *Felidæ* (cats), *Viverridæ* (civets), and *Hyænidæ*.

Æmilianus. Emperor of Rome 3 months, 253.

Æneas. Fabled son of Anchises and Aphrodite. He fought at siege of Troy, and after its fall fled with his father. Homer seems to regard him as reigning near Troy, but later traditions assign him different careers. According to Virgil's *Æneid*, of which he is the hero, he went to Sicily and Africa, finally settling in Latium, where he became founder of the Latin nation.

Æneas Tacticus. Ancient Greek writer upon the art of war.

Æolian Colonies. On w. coast of Asia Minor, from Bœotia and Thessaly.

Æolian Harp. Strings on a wooden frame, placed in a window, and played upon by the wind.

Æolotropic. See ISOTROPIC.

Æolus. God of the winds. He dwelt on one of the Lipara islands, where he kept the winds imprisoned in a cave.

Æon. Greek term for an indefinite lapse of time.

Æpinus, FRANZ ULRICH THEODOR, 1724–1802. Prof. in Berlin and St. Petersburg. He wrote on the temperature of the earth and the general phenomena of the atmosphere.

Æpyornis. The legendary "Roc," a dromæognathous bird recently exterminated in Madagascar. In 1851 the first description appeared of its egg, which had a thick shell, measured 8½ by 12½ inches, being 34 inches in circumference, with a capacity equal to 144 hen's eggs, or two gallons. The leg bone of this bird measures eighteen inches in circumference at the head. The bird stood nearly fourteen feet in height. It was incapable of flight, having rudimentary wings, and, like the *Moa*, probably defended itself by kicking.

Æquales. Order of the Linnæan class *Syngynesia* (family *Compositæ*), having all the florets alike and perfect, as in Dandelion and Boneset.

Æqui-glacial Lines. Connecting points on the earth's surface, for which the condition of the glaciation or formation of ice has the same phase (*i.e.*, equal thickness, duration or total amount) simultaneously.

Æquoridæ. Family of campanularian *Hydromedusæ*, which have numerous radial canals and tentacles.

Aërated Bread. Made by agitating the dough in a strong vessel with water saturated under pressure with carbon dioxide. When the dough thus treated is released from pressure and exposed to the air, the gas escapes in bubbles, and lightens the mass as effectually as that involved within its substance by fermentation.

Ærenchyma. Spongy parenchyma borne by submerged portions of certain aquatic plants.

Aërial Railway. Elevated wire or track for guiding a flying machine, the power being applied by an electric current through the wire to a motor in the machine. This has been proposed as a possible solution of the problem of aërial navigation.

Aërial Roots. Those produced in the air, as the secondary, climbing roots of the Ivy and Trumpet Creeper, and those which form accessory stems in the Banyan Tree and the Mangrove.

Aërius. Heretic of Armenia, who ab. 360 anticipated some of the principles of Protestant Dissent. He and his followers were condemned and persecuted.

Aërobic Bacteria. Those growing only in the presence of free oxygen, however slight in amount.

Aërodromics. Science of navigating the air.

Aërodynamics. Department of mechanics which treats of the phenomena exhibited by gaseous bodies, whether at rest or in motion.

Aëroklinoscope. Apparatus introduced by Buys-Ballot 1866 into ports of the Netherlands to show publicly the prevailing barometric gradient, and the equivalent atmospheric slope, as well as the wind that, according to his rules, must be expected during the next twenty-four hours. It consists of a mast to the top of which a cross-piece is so fastened that it can be set at any azimuth and any angular inclination to the horizon, thereby indicating the steepness of the barometric gradient for the given azimuth.

Aërolite. Masses of stone or iron that have fallen to the earth from the sky. See METEORITE.

Aërophyte. Plant which grows in the air, not rooted in the soil. See EPIPHYTE.

Aëroscope. Apparatus for examining the air, especially one in which the floating impurities are separated from a known volume.

Aërostatics. Principles and laws governing the static equilibrium of gas, especially the earth's atmosphere.

Aëro-steam Engine. One which uses a mixture of air and steam in the cylinder to drive the piston. The air is pumped into the steam chest at the same pressure as the steam received from the boiler. Air acts to retard condensation of steam when intimately mixed with it; but experiments, where no complicated apparatus was used to secure such mixture, showed that a good engine used the same amount of feed water per horse power per hour, whether using the air mixture or steam without air.

Æschines, 389–314 B.C. Athenian orator. He attained high office by military successes, was won over by Philip, and became chief of the Macedonian party at Athens. Was opposed by Demosthenes, but held his ground, and, as embassador to Philip and to the Amphictyonic Council, opposed the national party. Accused of having received bribes and assisting the enemies of Athens, his influence declined. The battle of Chæroneia in 338 B.C. decided the fate of Greece. Ctesiphon proposed that a crown of gold be given Demosthenes. The form of the proposition being illegal, A. brought an action against him, and Demosthenes defended him in his famous Oration on the Crown. The latter won, and A. went into banishment. He founded a school of eloquence at Rhodes.

Æschylus, 525–456 B.C. First great Athenian tragic poet. He fought bravely at Marathon, Artemisium, Salamis and Platæa, improved the stage, and was recognized as chief in tragedy 484–468, when he was defeated in a tragic contest by Sophocles. He then left Athens and went to Syracuse, to the court of King Hiero. Ten years later he seems to have been again in Athens, but afterward returned to Sicily, where he is said to have been killed by a stone let fall by an eagle. His style was bold, majestic, full of energy and rich in imagery. He sought to teach high moral truth. Plays extant: *Persians, Seven against Thebes, Suppliants, Prometheus, Agamemnon, Choephori, Eumenides.*

Æschynite. Mineral found in the Ilmen Mountains, Siberia, containing columbium, thorium, cerium, lanthanum and yttrium.

Æsculapius. God of the healing art; son of Apollo, reared and taught by the centaur Chiron. He sometimes even restored the dead to life, for which Zeus slew him with a thunderbolt. The serpent was sacred to him, and the cock was sacrificed to him. In the Iliad, he is the "blameless physician," but not divine.

Æsculin. $C_{21}H_{24}O_{13}$. Glucoside occurring in the horse-chestnut and related plants.

Æsculus Hippocastanum. Horse-chestnut; tree grown for shade and ornament, native of Asia.

Æsculus hippocastanum.

Æsop. Greek fabulist, ab. 570 B.C.; said to have been a deformed slave, who gained his freedom, traveled, and conveyed instruction in the form of fables. Those attributed to him were long handed down by oral tradition.

Æsopus, CLAUDIUS. Roman actor of first century B.C.

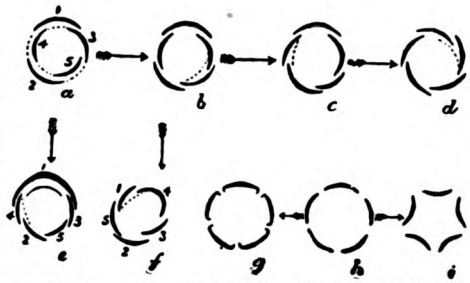
Æsthacytes. Surface cells in Sponges that bear sensory hairs and have sensory functions.

Æsthesiometer. Pair of compasses or bar with one fixed and one movable point by means of which the sensibility of the skin is tested, the points being brought together until it is no longer possible for the patient to tell whether one or two are pressed upon the surface.

Æsthetic Intuitionism. View which regards virtues as excellences of conduct, clearly discernible by trained insight, although their nature does not admit of being stated in definite formulæ.

Æsthetics. Science and philosophy of the Beautiful. Plato associates it with the Good, others with the intellect, and still others claimed utility as a factor. Baumgarten, 1750, asserted that the Beautiful is appreciated by the senses, without reference to Utility, the Good or the Intellectual, and founded the modern school of Æstheticism.

Æstivation. Summer sleep of animals, allied to hibernation. In botany, arrangement of organs of a flower in the bud; præfloration.



Various forms of Æstivation regarded as modification of the quincuncial or valvate type:

a, quincuncial; *b*, half-imbricate; *c*, imbricate; *d*, contorted; *e*, vexillary; *f*, cochleate; *h*, valvate; *g*, valvate induplicate; *i*, valvate reduplicate.

Æstus. Boiling or rising of the sea; term used by Hooke 1715, apparently equivalent to rise of tides.

Æthalium. Mass formed by the fusion of several plasmodia of the *Mycetozoa* or *Myxomycetes.* It is sometimes a foot in diameter and an inch thick, and is supported by the CAPILLITIUM (q.v.).

Æthelberht, Æthelred, etc. See ETHELBERT, etc.

Æther. Extremely elastic, rare medium, supposed to pervade all space, whether containing matter or not. It is by means of undulations in the æther that light and all other forms of radiation are propagated with the enormous speed in free space of 300,000 kilometers per second. According to Kelvin, the density of the æther is 9.36×10^{-19} compared with that of water, and its rigidity ab. 10^{-9} that of steel. As radiant energy is propagated by transverse vibrations, and as fluids are not capable of transmitting such vibrations, the æther must possess certain properties characteristic of a solid.

Æthiops Mineral. HgS. Black compound of mercury and sulphur, similar in composition to the native mineral metacinnabarite.

Ætiology. Science of the causes for the phenomena of natural history. The works of Darwin are examples. See ZOOLOGY.

Ætolia. Grecian State, s. e. of Acarnania. In Thucydides' time the people did not speak Greek, and ate raw flesh. It became subject to Rome 189 B.C., and in 146 was incorporated in the province of Achaia.

Ætolian League. Important ab. 250 B.C.; opposed to Achæan League and Kings of Macedon.

Ætomorphæ. ACCIPITRES. (q.v.).

Afer, DOMITIUS. Roman orator of first century, infamous as an accuser and informer.

Affection. In mathematics, sense of the respective inequalities of two or more quantities compared with a common standard. Two angles or arcs of the same affection are either both less or both greater than 90°, of different affection are one less, the other greater, than 90°.

Affections. Emotions directed toward conscious beings, as love and anger; distinguished from the appetites by their less material nature, and from the sentiments by their more instinctive and immediate character.

Affidavit. Written or printed statement sworn to before an authorized person. In the absence of statutory requirement, it need not have a title nor the signature of the affiant, but it should have the signature of the officer administering the oath.

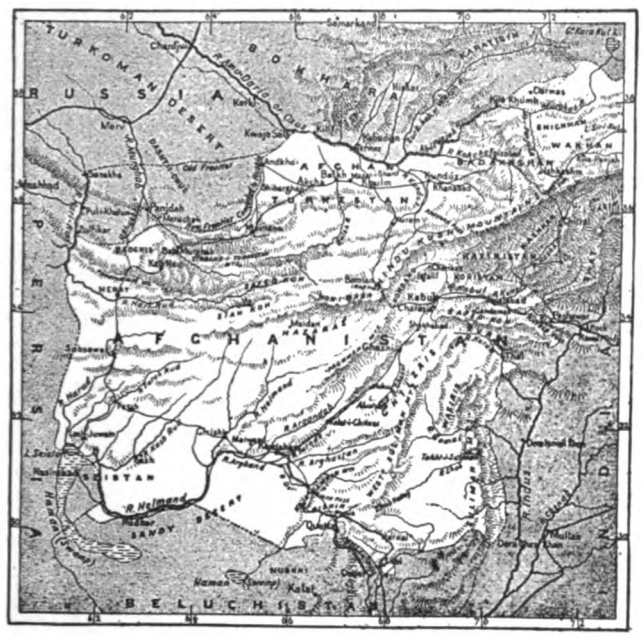
Affinities. In animals or plants, their relationships, as based on the truth of the idea that all living forms can be ultimately traced to common ancestors, which is the basal idea in the evolution doctrine. They are shown by the closeness of the similarity of structure, not only of the adults, but now biologists consider embryonic characters (especially when not kainogenetic) to be of even greater importance in deciding affinities. The more distant the affinities, of two forms, the further back in geologic time must we place the hypothetical common ancestors (See SYNTHETIC TYPES). The conditions of environment, that have caused differentiation of the descendants of these ancestors, have not acted uniformly as to time and place.

Affinity. In sex, or sexual attraction, shown in biology by Darwin's experiment of placing pollen on the stigma derived from two flowers, one nearly and the other distantly related to the fertilized flower. The pollen from the more distant relative was shown to be prepotent, its pollen tubes growing faster than those of the rival. This experiment has a wide and deep significance, and throws light on many obscure questions as to causes of human sterility.

Affinity, CHEMICAL. Force which causes atoms to unite to form compounds. The manner in which this force acts, or anything concerning its nature, is unknown.

Affray. Fighting by mutual assent of two or more persons in some public place, to the terror of the people.

Afghanistan. Country of Asia, between India and Persia, mostly 4.000 to 7,000 ft. above the sea, with mountain ranges; area ab. 250,000 sq. m., pop. ab. 5,000,000. It was freed from Persian rule by Ahmed Khan, 1747–73, who founded Douranee dynasty; in 1829, was divided between Dost Mohammed and his two brothers. The English governor of India declared war on A. 1838 because of hostile movements against India; British forces entered Cabul, but were soon obliged to retire, and in their retreat were so harassed by the natives that, out of a host of 26,000, including women and children, only one man escaped.



Akbar Khan was afterward defeated, and Cabul laid waste. In 1846 the Afghans allied themselves with the Sikhs against the British, but were driven back. Shere Ali succeeded Dost M. in 1863. His refusal to receive a British Mission 1878 led to an invasion. Jelalabad and Kandahar were occupied; Yakub Khan succeeded Shere Ali 1879, and peace was negotiated, a British resident to be at Cabul, and the British to defend A. against foreign aggression, the Ameer receiving a subsidy. A revolt, in which the resident was slain, led the Ameer to put himself under British protection, and Cabul was occupied.

Afghan Language. Of the Iranian family, related to modern Persian. It contains a considerable literature, mainly in the shape of ballads.

A Fortiori. Argument and conclusion which are stronger than a given proposition already accepted.

Afranius, Lucius, b. ab. 150 B.C. Chief writer of the class of Latin comedies called *Togatæ*, treating of Roman life. Only fragments remain.

Africa. One of the grand divisions of the eastern continent. It is rudely pear-shaped, with the smaller end toward the south. It lies almost entirely within the tropics, the equator dividing it into nearly equal parts. Its area is 11,092,750 sq. miles. Its surface is almost entirely a plain, bordered near the coast almost everywhere by mountains. In the north, this plain is low, most of the Sahara, Egypt and the Soudan being less than 1,500 ft. above the sea, and part of the former below its level. Further south, it rises to a plateau, large parts of which are 3,000 ft. or more above the sea. The surface of this plain is undulating, in some places hilly, and occasionally broken by mountains. The highest region is in Abyssinia, while further south, almost under the equator, is Mt. Kilimanjaro, 18,800 ft., the highest point in A. Another high range is the Atlas, near the Mediterranean shore, whose mean elevation is 2.021 feet. The climate is everywhere characterized by great heat. The n. part, including the deserts of Sahara and Egypt, is arid in the extreme. The equatorial portion has an excessive rainfall, and is covered by luxuriant tropical vegetation. In the s. part is a second area deficient in moisture, the Kala-hari desert and surrounding regions, destitute of trees, though covered with grasses.

The coast is extremely simple, with few indentations or islands. As a result of its peculiar form of relief, a plain encircled by mountain ranges, nearly all the drainage is effected by a few large streams. These are the Nile, Niger, Congo, Zambesi, and Orange rivers. The population of A. is estimated at 205,823,000. Except in the s. parts, where the Dutch and English have peopled large areas, the inhabitants are barbaric or semi-barbaric.

A high state of civilization was known in Egypt 4000 or 5000 B.C. Colonies were established on the n. coast of A. by the Phœnicians ab. 1000 B.C. Necho (or Neku) II. of Egypt is said by Herodotus to have sent his Phœnician sailors to circumnavigate A. ab. 600 B.C. Hanno of Carthage sent out an expedition which sailed along the w. coast, perhaps as far as the Bight of Benin. In 1486 Diaz rounded the Cape of Good Hope, and in 1497–98 Vasco da Gama circumnavigated the continent. The Niger gave up its secret to Mungo Park 1795–97. The Nile, more chary of its mysteries, challenged the curiosity and taxed the endurance of explorers from 1810 down to 1881. South and Central A. have been explored and laid open to civilization and Christianity by the intrepid and persistent efforts of Livingstone, Stanley, Cameron, and others, 1854–89. Great Britain, France, Portugal, Spain, Germany, Italy, and Turkey now control about a fourth of Africa.

Africa, Church of. Beginning about 110, with Carthage as its chief city, it produced such eminent men as Cyprian, Tertullian, and Augustine, and was long, after Rome, the most influential part of Latin Christendom, till rent by the Donatist schism, crushed by the Vandals, and at last obliterated by the Saracens.

African Languages. Besides the Semitic and Hamitic groups, represented by Berber, Ethiopic, Egyptian, and the like, there is an interesting group, some fairly well studied, and others still lacking adequate analysis, as the Negro, in the Soudan; the Bantu, including Congo and Zulu; and the Hottentot. These are mainly agglutinative, but show advanced development and capacity of expression. See Cust, *Modern Languages of Africa*, London, 1883.

African M. E. Church. Founded in America 1816. It now has over 4,000 ministers and nearly 500,000 members.

African M. E. Zion Church. Organized in N. Y. 1820. It had in 1891 3,650 ministers and 425,000 members.

African Races. Much dispute has raged about the question of how many distinct races inhabit Africa, but it is certain that at least three distinct groups may be recognized. 1. S. African Negroes (Hottentots, Kaffirs, and Bushmen). 2. Mid-African Negroes. 3. N. African races, which probably came from Asia (Berbers, Moors, Nubians).

After-damp. Mixture of carbon dioxide, nitrogen, and aqueous vapor, resulting from an explosion of fire-damp. It quickly causes death by asphyxia.

After-glow. Sudden increase in brilliancy of the diminishing evening twilight. This occurs when the rosy glow is at its brightest, and, like it, depends on the diffraction of solar rays by fine particles in the atmosphere.

After-images. Those which continue after one has ceased to look at a bright object. They were first described by Aristotle, and have been investigated by many eminent men, including Augustine, Newton, Buffon, Erasmus, Darwin, Goethe, Fechner and Helmholtz. The image which remains may, at first, be similar to the original object in brightness and color, in which case it is called positive; thus a rocket or a meteor leaves a trail of light, and the positions of a trotting-horse are fused into a continuous whole. But after the eye has been exposed to a bright light, the image is likely to be the opposite of the original; thus the image of the sun is seen as a dark circle, and this is called negative. When the object is colored the image is apt to be of a complementary color, the image of a red object, *e.g.*, appearing green: this is called complementary.

Afzelius, Adam, 1750–1837. Swedish botanist; prof. Univ. Upsala 1812.

Afzelius, Arvid August, 1785–1871. Swedish historian, tr. Edda, 1818, ed., with E. G. Geijer, ballads, 1814–16.

Agallocha. *Excœcaria Agallochum*, Indian shrub of the natural family *Euphorbiaceæ*, having an extremely acrid juice, used in Fiji as a cure for leprosy. Also, Eaglewood (*Aquilaria Agallocha*) of Java.

Agalmatolite. Image-stone. Chinese mineral used for carvings. Also several compact, amorphous, light-colored, soft, and easily-worked hydrous silicates, in which the bases are usually aluminum or magnesium and potassium.

Agamic. Organisms not differentiated into sexes, as *Bacteria*. See Asexual Reproduction.

Agamemnon. Son of Atreus, king of Mycenæ, brother of Menelaus. He married Clytemnestra, daughter of Tyndareus, and succeeded Thyestes as king of Mycenæ; was commander-in-chief of the Greek hosts at Troy; on his return was murdered

by his wife, or, as Homer has it, by Ægisthus, who had seduced her.

Agamogenesis. Asexual reproduction, as budding, fission, and production of eggs that will develop without fertilization. The latter process is usually known as PARTHENOGENESIS (q.v.).

Agamospore. Propagative body or spore produced asexually.

Agapæ. Festal entertainments of the early Church, to show mutual hospitality; originally connected with the Eucharist, but soon separated from it. They disappeared about 720, but are imitated in the Love-feasts of Moravians and Methodists.

Agapetus. 1. Pope, 535–6, and legate from the Ostrogothic king to the Byzantine emperor. 2. Pope, 946–955.

Agapornis roseicollis (LOVE BIRDS). Genus of small parrots, found in Africa.

Agapornis roseicollis.

Agaracin. Active principle from White (Larch) Agaric, *Polyporus officinalis*. It is a white, amorphous powder, and is used to check night-sweats of phthisical patients.

Agar-agar. Gelatinous substance used in microscopy, derived from a red sea-weed, *Gracilaria lichenoides*, native of the Indian Ocean.

Agardh, JAKOB GEORG, b. 1813. Swedish botanist; prof. at Lund. Author of *Algæ maris mediterranei et adriatici*, 1842; *Species, genera et ordines Algarum*, 1848–63; *Theoria systematis plantarum*, 1858.

Agardh, KARL ADOLF, 1785–1859. Swedish botanist. *Dispositio Algarum Sueciæ*, 1810–12; *Synopsis Algarum Scandinaviæ*, 1817; *Species Algarum*, 1823–28; *Systema Algarum*, 1824; *Icones Algarum Europæum*, 1828–35.

Agaric Mineral. $CaCO_3$. Soft, crumbly variety of carbonate of lime.

Agaricini. Family of *Fungi* of the order *Hymenomycetes*, including the cultivated mushroom and many toadstools.

Agassiz, ALEXANDER, LL.D., b. 1835 in Switzerland. Son of LOUIS; assistant on coast survey and northwest boundary, 1859; taught zoölogy in Harvard, 1860–65; superintendent of Calumet and Hecla copper mines on Lake Superior, 1869; curator of Harvard Museum, 1874–85; member of the exploring expeditions of the *Blake*, 1876–81; author of many papers on Marine Zoölogy.

Agassiz, LOUIS JOHN RUDOLPH, M.D., LL.D., 1807–1873. Swiss naturalist; prof. Harvard 1848; celebrated for his studies of the fishes of Brazil, 1829; fresh water fishes of central Europe, 1839; fossil fishes, 1844; Echinoderms, 1840; and the glacial theory, 1840–46. He pub. four folio vols. on *Natural History of U. S.*, 1857–62; a Zoölogy, and a Catalogue of Zoölogical and Geological Memoirs. He visited Brazil 1865, the southern shores of N. America 1871. The Marine Laboratory of Biology was started 1872 on Penikese Island, which, though short-lived, was the real ancestor of six marine laboratories now located on our coast. Although an opponent of Darwin, his investigations in embryology have done more to establish the evolution doctrine than the work of any one man. Great as is his name as a discoverer in the field of Natural History, it is as a teacher that his influence has been greatest; a great educational movement in America is directly the result of his labors. Every teacher of Biology in America owes his best methods, enthusiasm, inspiration and success either directly to Agassiz or to his influence. The influence of Huxley on biological education in America has secondarily been grafted upon this original stem.

Agate. SiO_2. Silica. Non-crystalline, translucent, variegated quartz, capable of taking a high polish. The colors sometimes shade gradually into each other, and are sometimes arranged in parallel bands. The differently colored portions are often affected differently by chemical reagents, and the natural colors can be materially changed by artificial means. Good agates are found in many parts of the U. S., especially ab. Lake Superior and at several points in the Rocky Mountains. Brazil and Hungary furnish large and fine stones, which are polished for market at Oberstein, Germany.

Agathias, 536–582. Greek rhetorician at Constantinople. Of his works near 100 poems and a history of the wars of the period remain.

Agatho. Pope 678–682.

Agathocles, 361–289 B.C. Tyrant of Syracuse from 317.

Agathon, ab. 447—ab. 400 B.C. Athenian tragic poet.

Agave. Large genus of plants of the family *Amaryllidaceæ*, comprising the century-plant and its relatives; noteworthy for their extremely succulent leaves of great dimensions.

American Aloe (*Agave americana*).

Age of the Sun. From the commonly received hypotheses it is believed that the sun could not have existed in its present condition for more than 18,000,000 years.

Ages of the World. The Greek and Roman poets made four ages, named after the metals, Gold, Silver, Bronze, and Iron. The first passed in peace and plenty under the mild rule of Cronos (Saturn); the others became each worse than the preceding, till the present, the Iron Age, is one of fraud and toil and suffering. When it set in, Astraea went back to heaven, and Zeus destroyed the race by a flood in order to begin anew. Lucretius makes three ages, of stone, bronze, and iron, according to the material of which tools were successively made.

Agent. One empowered to act for another. The authority may be given expressly or by implication, and before or after the act. Agency may be revoked at the will of the principal, unless it is coupled with an interest in the subject matter of the agency, as distinguished from the proceeds to which the agent may be entitled as compensation for services. However, the principal may be liable to the agent in damages for breach of contract in revoking the agency even when he has the power to do so. The acts of an agent within the apparent scope of his employment bind the principal, although these acts have been forbidden. In case of simple contracts, the principal may sue or be sued, although they were made in the name of the agent; but this rule does not apply to sealed instruments or negotiable paper. If an agent exceeds his authority in making a contract for his principal, so that the latter is not bound thereby, he thereby becomes liable to the third party. As between themselves, the agent is bound to obey his principal's instructions, to keep and render their accounts, and to act with the utmost good faith. He cannot derive a benefit to himself from his principal's business. Nor can he delegate his authority unless empowered to do so, although, if the business is of a kind which requires the employment of subordinates by the agent, he has implied authority to employ them.

Agglomerate. Mass of angular stones imbedded in a paste of volcanic material; differing from a Breccia only in being constructed on a larger scale.

Agglutinative Languages. According to Max Muller's

classification, those which join two roots or root-words to make one word, often causing one of these roots to lose its independence. An English example is "God like," as compared with "godly," where the "like" has become a mere termination and does not count as a word. Finnish, Hungarian, Turkish, and similar tongues are agglutinative.

Aggregate. Fruit composed of a cluster of ripened ovaries from a single flower, as the raspberry and blackberry.

Aggregation. Change in structure of the protoplasm in cells of vegetable organs which are sensitive to shock, or, in general, display irritability.

Aghrim, IRELAND. Scene of a decisive English victory, July 12, 1691, over the Irish, who lost 4,000 killed.

Agias, ab. 740 B.C. Cyclic epic poet, author of a story of the return of the Greeks from Troy, not extant.

Agincourt. Village of N. France. Here some 10,000 English under Henry V. gained a memorable victory over 60,000 French, Oct. 25, 1415, with loss of 1,600. The French lost 10,000 slain, including 3 dukes, 5 counts, 90 barons, and 1,500 knights, besides 14,000 prisoners.

Agio. Difference of value between moneys, whether paper or metallic.

Agiotage. Stock-jobbing, as distinguished from commercial speculation. The latter is usually actual purchase, delivery, and sale of goods, while agiotage refers to successive conveyances of title for the purpose of gambling in the differences existing from time to time in the price.

Agis. Three kings of Sparta. I., 427-398 B.C.; active in Peloponnesian war; he several times invaded Attica. II., 338–330 B.C., revolted when Alexander was in Asia; was defeated and killed by Antipater. III., 244–240 B.C.; undertook to reform the Spartan state; was thrown into prison by his colleague and slain by order of the Ephors.

Aglossa. Tribe of *Anura* (*Batrachia*), characterized by the absence of the tongue. The eustachian canals meet in one opening in pharynx. The hind feet are webbed. *Pipa dorsigera*, the Surinam Toad, is an example. The male of this species places the eggs, when spawned, upon the back of the female, and the skin grows up around each to form a brood-pouch in which the larval stages of the young are passed. There are first external branchia; these give way to internal ones, and finally respiration is confined to the lungs. A swimming tail is present for a time, although the young are never aquatic.

Aglyphodonta. Group of *Colubriformia*, including non-poisonous snakes, with numerous solid conical teeth. The head is covered with large shields. The principal families are *Colubridæ*; including most common snakes, and the *Peropoda*, Pythons, Old-World Constrictors with premaxillary teeth, and the New-World Boas and Anacondas.

Agni. God of Fire, first of the three great gods of the ancient Hindu pantheon, to whom, with Indra and Soma, the hymns of the Rig-Veda are chiefly addressed. God of both celestial and terrestrial fire, he manifested himself in the heavens by the sun and moon, and was produced on earth at the hands of the sacrificer by rubbing two pieces of wood together.

Agnodice. Athenian midwife, tried for practicing in a man's dress, and acquitted. Believed to have been the first woman accoucheur.

Agnoëtæ. Two heretical sects, followers (I.) of Theophronius of Cappadocia, an Arian, ab. 370, who ascribed to Deity only partial knowledge of the future: (II. and chiefly) of Themistius of Alexandria, a Monophysite, ab. 550, who held that Jesus was ignorant as to many matters, especially the Day of Judgment.

Agnosticism. Doctrine that of the ground of the universe, whether personal or impersonal, conscious or unconscious, free or blindly necessary, nothing can be known. An agnostic, properly, is neither believer nor unbeliever, but one who suspends his opinion for lack of evidence.

Agnostus. Small genus of Trilobites, showing the structure of that family in a very simple form. The thorax contains only two segments; the head and tail are nearly equal and alike; eyes are wanting. Numerous species occur in the Ordovician and Cambrian strata.

Agnus Dei (LAMB OF GOD). Form of words based on St. John i. 29, incorporated in the Mass ab. 680, retained by Luther, and by Ch. of England in the Litany.

Agobard, 779–840. Abp. of Lyons from 814. He wrote against verbal inspiration, image-worship, ordeals, adoptionism, etc. His works were collected 1605 and 1666.

Agonalia. In Roman Antiquity, festivals in honor of Janus, Jan. 9, May 21, and Dec. 11.

Agonic Line. See DECLINATION.

Agonothetes, or AGONOTHETA. President of the ancient sacred games in Greece. Sometimes this was the person who met the expenses of them, but at the Olympic, Pythian, and other public games he was the representative of the states concerned.

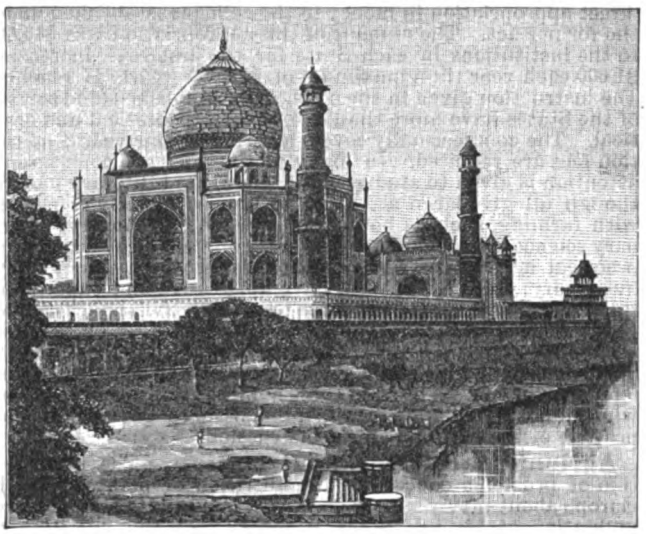
Agora. Public square or market-place of a Greek city; also applied to the assemblies held there. It corresponded to the Forum in Rome and other Italian cities.

Agoranomoi. Magistrates in ancient Greek cities who regulated the commerce, police, and customs duties, somewhat as the Ædiles did in Rome.

Agostino da Montefeltro, b. ab. 1840. Italian preacher-called "the modern Savonarola." He is a Franciscan monk.

Agoult, MARIE CATHERINE SOPHIA, COUNTESS D' (b. Flavigny), ("DANIEL STERN"), 1805–1876. French novelist. *History of the Revolution of 1848*, 1851.

Agra. City of British India, on the Jumna River; capital of the Mogul emperors and their successors 1504–1647. It contains



The Taj Mahal.

a splendid mausoleum, the **Taj Mahal**, built by Shah Jehan ab. 1660. Pop., 1891, 168,710.

Agraphia. Pathological state in which the power of expressing ideas by means of written symbols is lost or impaired. Usually found associated with APHASIA (q. v.).

Agrarianism. Tendency to introduce modifications of the established land system, either for a more equal distribution of ownership or conditions of tenure, or substitution of state for individual proprietorship.

Agrarian Laws. Pertaining to rights of ownership in land or its distribution in the community. Those of ancient Rome were intended to relieve the condition of the common people by regulating the distribution of public land; invariably opposed by the patricians and rich plebeians. The first, proposed by Spurius Cassius 486 B.C., resulted in his death 485. That brought forward by Tiberius Gracchus 135 was a virtual reënactment of the Licinian law of 366, limiting ownership to 500 jugera (350 acres). Tiberius was murdered with 300 of his friends. Gaius Gracchus, who pushed this with other reforms still further 132–123 B.C., lost his life with some 3,000 of his followers 121 B.C.

Agricola, CNÆIUS JULIUS. 37–93. Roman general and statesman; governor of Aquitania 73; consul 77; governor of Britain 78–85; recalled because of Domitian's jealousy; father-in-law of Tacitus, who wrote his life.

Agricola, or BAUER, GEORG, 1494–1555, "Father of Metallurgy." Prof. at Chemnitz, in the Saxon mining district. He made many excursions to the mines and metal works of Germany, Austria and Italy, and wrote painstaking and lucid descriptions of all the metallurgical processes then in use. His *De Re Metallica*, pub. 1546, is the first systematic treatise on the mining and smelting of metalliferous minerals and contains true accounts of methods still in use.

Agricola, or SCHNEIDER, JOHANN, 1492–1566. German reformer, charged with Antinomianism.

Agricola, or HUYSMANN, RUDOLPHUS, 1443–1485. Frisian scholar, who taught in Italy and Germany, and promoted the revival of learning.

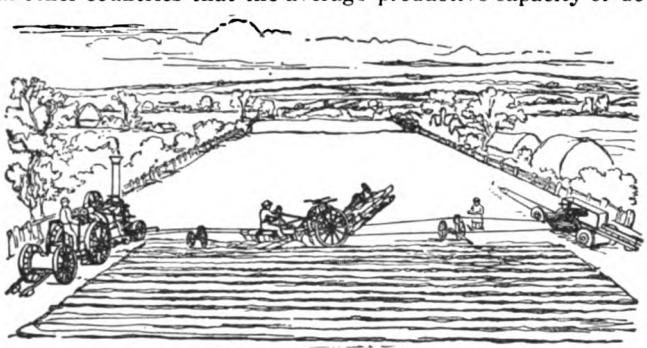
Agricultural Education. No colleges teaching the various arts and sciences connected with agriculture were founded before the 19th century. In Great Britain, the first and still the largest of these, that at Cirencester, was established and is still maintained by private benefactions and the fees of students. Most of the continental schools and colleges have been instituted directly or indirectly by government. In the U. S. efforts had been made for the establishment of agricultural colleges in several States before the middle of the century, and in a few cases, notably in Mich. and Pa., such colleges were in operation before 1861. The real beginning of agricultural education in this country dates from 1862. In that year Congress passed "the Land Grant Act," which donated to each State a certain amount of public land for the endowment of "at least one college where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts." The amount of land so donated amounted to 30,000 acres for each senator and representative to which the State was entitled, and the endowment resulting from its sale amounts in some of the larger States to several hundred thousand dollars. In 1890 another Act was passed making a continuous direct appropriation in money to the colleges established under the former act. The amount of this appropriation was $15,000 to the institutions in each State for the first year, increasing $1,000 each year till a maximum of $25,000 yearly is reached. The instruction given in the colleges so established (and several of the States have more than one) is both theoretical and practical. The course usually covers a period of four years; no tuition fees are required. In many of the colleges considerable attention is given to studies of a general and literary nature, though all give large attention to studies directly connected with farming, such as botany, chemistry, entomology, veterinary science, and geology, and to the more technical branches of practical agriculture and horticulture, stock-breeding, dairy-husbandry, etc. All of them have illustrative and experimental farms, on which the students are shown the applications of the principles learned in the class-room, and most of them require of the students more or less practice in the more intricate operations of the farm and garden. Many of the colleges also offer shorter courses of from three months to two years to those who cannot spend a longer time, but wish to get as much as possible of the more technical instruction.

Agricultural Experiment Station. The investigation of problems concerning the nutrition of plants began in Europe about fifty years ago. It was inaugurated by the promulgation of Liebig's "mineral theory" of the nutrition of plants in its relation to the fertility of the soil. Since then a large number of stations have been established for the investigation and systematic study of all problems of near or remote interest to agriculture. The work of most of the stations covers the whole ground of agricultural industry, though some confine their work to particular lines of inquiry. In this country the work was begun soon after the establishment of agricultural colleges, though the first station was not established until 1877 at Middletown, Conn. In the following ten years something more than a dozen stations had been established in various parts of the country, both by State aid and individual enterprise. In 1887 great impetus was given to the work by the passage by Congress of the "Hatch Act," granting $15,000 yearly for the establishment in each State of a Station in connection with its Agricultural College. These stations, though still young, have already reached important results on many lines of agricultural science, and are coming to be relied upon more and more by the farmer for the solution of difficult problems and for expert advice and assistance in details of farm management.

Agricultural State. Third of the stages through which most advanced branches of mankind have passed. It has followed the hunting and the pastoral state.

Agriculture. Literally culture of a field. The meaning has been both restricted and enlarged; thus the culture of fruits, vegetables and flowers is horticulture, while A. now includes not only field culture but other branches of domestic industry, as stock breeding, dairy husbandry, poultry keeping, apiculture, sericulture, etc. The history of A. is that of the human race. From remotest times fields have been cultivated and flocks and herds kept for the use of man. The *De Re Rustica* of Columella and the *Georgics* of Virgil are among the earliest written works treating upon A., but many of the ancient Greek and Roman writers gave attention to rural life. While population remained small and widely scattered, while the wants of man were few and easily supplied, though most obtained their support directly from the soil, A. still remained in a most primitive state, since the soil in its original fertility needs only the slightest preparation to produce luxuriant crops, and when the fertility is depleted, large areas of virgin soil are accessible, a condition that still obtains in all new and thinly settled countries. It is only when, with advancing civilization, an ever increasing population, and large areas depleted of their fertility, it becomes necessary to study the laws of nature in their application to plant and animal life, that the science begins to develop and the art to demand more and more skill in manifold directions. It is almost entirely within the present century that the practice of A. may be said to have been established upon a scientific basis. For though Sir Anthony Fitzherbert wrote *The Booke of Husbandrie* in 1523, and Thomas Tusser gave us his *500 Points of Good Husbandrie* in 1573, it was not till Liebig's *Chemistry in its Relations to Agriculture and Physiology*, 1840, that any rational scientific principles were established as a foundation for agricultural practice. Since then progress has been rapid in all branches of A. and its allied industries.

The laws of heredity, founded upon the observations of T. A. Knight, Darwin, and others, when applied to the breeding and rearing of live stock, have given rise to very great improvement in all the races of domestic animals, and to the formation of innumerable breeds. Practically all this improvement has taken place in the last hundred years. Robert Bakewell, b. 1725, was one of the first to improve his stock by an application of scientific laws in their selection and propagation. He was remarkably successful, particularly with sheep, and was followed by his pupil and admirer Charles Colling, who in connection with his brother Robert and Thomas Bates, so improved the native cattle of Durham and Northumberland that a new breed (now called Short Horn) may be said to have been formed. Their successes led to such increased activity in England and in other countries that the average productive capacity of domestic animals has probably nearly doubled, and individual animals have shown a far greater development.



Steam Plow at Work.

In no one line has the advance of A. within the last century been more marked than in the applications of mechanics to the operations of the farm, and in the substitution of horse- and steam-power for manual labor. So marked has the latter been that it is no doubt an important factor in the decline of the rural population in the older settled parts of the country that has been so marked a feature of the last two federal censuses. These labor-saving inventions are largely the result of American ingenuity, and some of the more important include the cotton gin, mowing machine, reaper, binder, steam plow, threshing machine, and many others in all branches of A. and domestic industry.

In the domain of horticulture and the culture of plants in general remarkable progress has also been made. The discovery of the laws governing the cross fertilization of flowers has had remarkable results in the formation of new and improved varieties through hybridization. A better knowledge of the use and effects of fertilizers and more careful and intelligent cultivation have also had great influence in the production of plants and fruits of a highly improved quality and productiveness.

In the same way the discovery of important principles or the invention of ingenious devices has resulted in economy of production or in increase in amount or quality of product in almost all the minor branches of A.; *e.g.*, the discovery by Goffart that fodder could be preserved in a green state in pits or silos has led to great economy in feeding animals, particularly cows giving milk, and the practice known as ensilage has been extensively adopted. The invention by Lefeldt and Lentsch of a machine for separating the cream from milk has led to a revolution in the methods of making butter, and resulted in both economy of production and improved quality of product.

The literature of A. is voluminous and goes back to remote antiquity. Morton's *Cyclopædia of A.*, Stephen's *Book of the Farm*, Loudon's *Encyclopædia of A.*, are the more important general reference works. The *Breeder's Gazette*, the *Cultivator and Country Gentleman*, the *Rural New Yorker*, the *American Agriculturist*, Hoard's *Dairyman*, *American Gardening*, *Garden and Forest*, are some of the more important American periodicals.

The governments of the U. S. and of the various States have from almost the first maintained a policy of State aid for the promotion and improvement of A. This first took the form of grants of money to be offered as premiums by societies organized to hold fairs and exhibitions of live stock, farm and garden crops, machinery, and the like. Later, agricultural schools and colleges were established, and still more recently large sums have been given for the investigation of problems by experiment stations and for the diffusion of knowledge through Farmers' Institutes.

Agriculture, DEPARTMENT OF. Branch of U. S. government, presided over by Secretary of Agriculture, who is a member of the Cabinet. The first official action of the government in the way of aid to agriculture consisted in the collection and dissemination of seeds, plants, and cuttings of new or little-known species and varieties. This work was done under the direction of the Commissioner of Patents. Later a separate commissionership was erected and the work greatly broadened, particularly in the application of the sciences of chemistry, botany, entomology, etc., to practical affairs. In 1889 the commissionership was erected into a secretaryship. The work of the Department now includes investigation in all branches of natural and economic science having near or remote relation to agriculture, and its publications include many of the most important contributions to economic science. The work is administered through several subdivisions, the more important of which are Botany, Vegetable Pathology, Chemistry, Entomology, Forestry, Microscopy, Ornithology and Mammalogy, Pomology, and Statics, the Bureau of Animal Industry, the Weather Bureau, and the Office of Experiment Stations.

Agrigentum. Populous city on s. coast of Sicily, founded by Dorians ab. 579 B.C., governed by Phalaris ab. 560 B.C.; destroyed by Carthaginians 405 B.C.; came into possession of the Romans 210 B.C.; now Girgenti.

Agrimony. Rosaceous plant, *Agrimonia eupatoria*, native of Europe. It is a stimulant and astringent, used for sore throat and bowel complaints.

Common Agrimony (*Agrimonia eupatoria*).

Agrionia. Annual Bœotian festivals, celebrated at night by priests and women in honor of Dionysus.

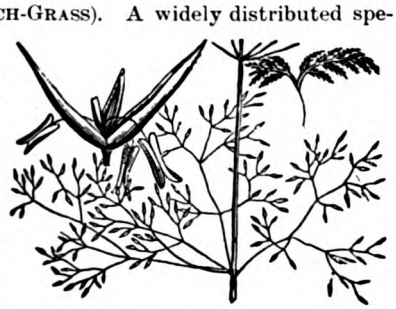
Agrippa, HEROD, 10 B.C.—A.D. 44. Grandson of Herod the Great, made tetrarch by Caligula and king of Palestine by Claudius. He beheaded James, imprisoned Peter, and died by the disease of tyrants (Acts xii.). His son and namesake, 27–96, king of Chaleis 44, and of part of Palestine 53, heard St. Paul's defense (Acts xxvi.), endeavored to prevent the Jews from revolting, and after the fall of Jerusalem lived at Rome.

Agrippa, HENRY CORNELIUS, 1486–1535. Physician and astrologer, by many regarded as an impostor and heretic. He gained the doctor's degree in divinity, law and medicine; wrote on the Occult Philosophy, and on the Vanity of the Sciences.

Agrippa, MARCUS VIPSANIUS, 63–12 B.C. Roman general, son-in-law of AUGUSTUS. His coins are numerous.

Agrippina, d. 33. I. Wife of Germanicus, granddaughter of Augustus, mother of Caligula and grandmother of Nero. She shared her husband's campaigns, and was banished by Tiberius 30. II. Her daughter, who poisoned Claudius 54, that her son Nero might succeed him, was murdered 59 by Nero's orders.

Agrostis alba (COUCH-GRASS). A widely distributed species of a large genus of grasses, desirable in pastures; bent-grass; marsh-bent, fiorin. Red top is *A. vulgaris.*



Agrostis alba.

Agrostology. Study of grasses.

Agroteras Thusia. Athenian annual festival to Artemis, held because of a vow made at Marathon to sacrifice as many goats as they should slay Persians in battle. It being impossible to do this, the number was set at 500.

Ague. Intermittent fever.

Ague Cake. Swelling noticed on pressing down upon the right side below the stomach in some cases of chronic malarial troubles, due to enlargement of the spleen.

Aguilar, GASPAR DE, ab. 1570–1650. Spanish poet and dramatist; translator of Tasso's *Aminta.*

Aguilar, GRACE, 1816–1847. English author; Jewess of Spanish descent.

Agulhas, CAPE. Southernmost point of Africa.

Ahab. Seventh king of Israel, 917–895 B.C.; son of the usurper Omri, and blindly obedient to his Baal-worshiping and persecuting wife, the Syrian princess Jezebel.

Ahasuerus. Title applied in Scripture to three kings of Persia. I. Astyages the Mede, father of Darius. II. Probably Cambyses, son of Cyrus, 529–522 B.C. III. Esther's husband, probably Xerxes, 486–465 B.C. The book of Tobit mentions a fourth.

Ahaz. Eleventh king of Judah, ab. 742–726 B.C.; a weak and idolatrous ruler. For help against his enemies he appealed to Tiglath-Pilesir of Assyria, who robbed the temple and made A. tributary.

Ahaziah. I. Eighth king of Israel, 897–896 B.C.; son of Ahab. II. Fifth king of Judah, 885–883 B.C.; named also Azariah and Jehoahaz; grandson of Ahab and Jezebel, and of like character; murdered by Jehu, with his uncle Jehoram, king of Israel, whom he was visiting.

Ahmadabad. City of British India, on left bank of Sabarmati River, founded 1412. Pop., 1891, 145,990.

Ahmes, ab. 1700 B.C. Egyptian. Author of the oldest reckoning book, so far as known the beginning of rules for computation.

Ahn, JOHANN FRANZ. 1796–1865. German grammarian. His helps to the easy acquisition of several languages followed a method of his own, often imitated since, and were very popular.

Ahriman. Principle of Evil in the Persian religion; opposed to ORMUZD.

Aidan, d. 651. Irish missionary to Northumbria; first Bp. of Lindisfarne, 635.

Aidé, HAMILTON, b. 1830. English poet and novelist of Greek descent. *Poet and Peer*, 1880.

Aide-de-Camp. Officer selected by a general to assist him in his military duties. His functions are difficult and delicate. Attached to the person of the general, he receives orders only from him, enjoys his full confidence, and represents him in writing orders, in communicating them verbally upon battle-fields and in maneuvers.

Aids. Incidents of feudal tenure, now abolished; to ransom the lord if captured, to knight the eldest son, and to provide dowry for the eldest daughter.

Aigret. Tuft of hairs attached to a seed or fruit, aiding in its dissemination.

Aiguillette. Decoration consisting of bullion, cords, and loops, worn with the full dress uniform by officers of the Adjutant-General's and Inspector-General's Departments, aides-de-camp, and adjutants.

Aikin, ARTHUR, 1773–1854. British chemist and mineralogist; author of a *Manual of Mineralogy*, 1814, and a *Dictionary of Chemistry and Mineralogy*, 1807–14.

Aikin, JOHN, M.D., 1747–1822. English biographer, author, with his sister, Mrs. Barbauld, of *Evenings at Home*, 6 vols., 1792–95. His daughter LUCY, 1781–1864, wrote several memoirs.

Aikinite. $CuPbBiS_3$. Sulphide of bismuth, copper, and lead, known also as needle-ore and acicular bismuth; found at Berezov in the Ural Mountains.

Ailanthus. Genus of *Simarubaceæ*, composed of a single species, *A. glandulosus*, a large tree, native of eastern Asia, but now widely cultivated; called Tree of Heaven, and in China Ailanto. The leaves of *A. glandulosus* are the favorite food of the silk worm (*Bombyx Cynthia*). A decoction or tincture of the dry bark has been recommended in asthma, epilepsy, dyspepsia and dysentery. It has also been used for the expulsion of the tape-worm in dogs, as well as in man, when given in form of the bark or leaves.

Aileron. Buttress in the form of an inverted console, usually with a colute at the lower and wider, and often also at the upper and narrower end. It appears only in the architecture of the Renaissance, and is commonly of small dimensions, flanking free-standing doorways, dormer-windows, and the like, and connecting them with columns or pilasters or with a continuous parapet. In Italy it was employed on a large scale, as in the Jesuit Church in Rome and in Santa Maria della Salute in Venice, where it extends completely over the aisle.

Ailli, PIERRE D', 1350–1420. French prelate; Chancellor Univ. Paris 1389, Abp. of Cambrai 1397, Cardinal 1411. At the Council of Constance he urged reforms, secured the abdication of Pope John XXIII., and presided at the trial of Huss.

Ailobranchia. Group of *Nudibranchiata*, including two sub-groups, *Ceratonota* (Triton) and *Haplomorpha*. Triton is distinguished by having its gills in two rows along the back.

Aimard, GUSTAVE, 1818–1883. French novelist and traveler, long resident in America. *The Adventurers.*

Aimé, GEORGES, 1813–1846. Prof. in the College of Algiers; first inventor of a nephoscope for accurate observation of the motion of clouds by reflection from a mirror; author of works on waves and terrestrial magnetism.

Ainmüller, MAX EMANUEL, 1807–1870. German glass-painter of cathedral windows.

Ainos. Aborigines of Japan, now confined principally to Jeddo. They are Asiatics of doubtful origin, shorter in stature than Japanese, but broader-shouldered, of dark brown color, large head, retreating brow, full lips, oblique eyes, prominent cheek bones, excessively hairy bodies, hardy and long-lived. They are shy, friendly, but irascible when irritated. They go bareheaded and barefooted in the severest weather, live in tent-shaped huts of reeds, with one room. Dogs are constant companions; the women do most of the work; they tattoo and ornament themselves. The cooking is rude, the men hunt. The religion is ancestor-worship mixed with other superstitions. They have no written language. Polygamy is practiced. They number ab. 17,000, and are losing ground.

Ainsworth, HENRY, D.D., ab. 1570–1662. English Brownist, pastor at Amsterdam. *Annotations on the Psalms*, 1612; *On the Pentateuch*, 1621.

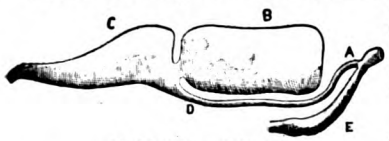
Ainsworth, ROBERT, 1660–1743. English lexicographer. His Latin Dictionary, 1736, long held a high place.

Ainsworth, WILLIAM HARRISON, 1805–1882. English novelist; ed. *New Monthly*, 1845. *Jack Sheppard*, 1839; *Tower of London*, 1840.

Air. Between 1750 and 1800 this word was used by chemists as equivalent to gas in the expressions "atmospheric air," "dephlogisticated air," etc., but this use is now obsolete. Also, the lightest movement of wind that is perceptible to an observer, as in the expressions, "light airs," "gentle airs." See ATMOSPHERE.

Air. Melody or tune in a piece of music; specifically, an accompanied solo of certain form, either for the voice or an instrument. In this sense it is the English equivalent of the more generally used Italian term ARIA (q.v.).

Air-bladder, or SWIMMING-BLADDER. Sac under control of a fish, used to maintain equilibrium. In highest fishes it is really a lung. Isinglass, made from this, is a variety of gelatine.



Air-bladder of Carp:
Consisting of two parts, B and C, joined by a narrow neck; A D, a canal communicating with œsophagus, E.

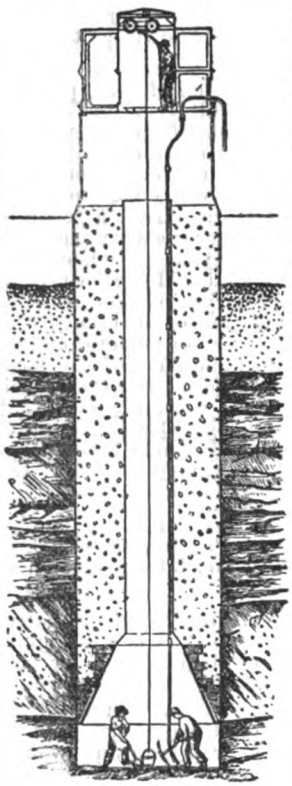
Air-brick. Iron box or grating of the size of a brick, built into a wall to allow air to pass through.

Air-cells. Round or polygonal cavities in the lung, about 1-100 of an inch in diameter, which communicate with the smaller bronchial tubes, and in the walls of which are numerous small bloodvessels whose coats are so thin that the oxygen of the air is readily taken up by the blood.

Air-chamber. Vessel or reservoir so attached to a pump or to the pipe through which an incompressible fluid is moving, as to imprison a volume of air. The shape is usually an inverted cone, or less often a cylinder. The imprisoned air acts as a spring or cushion to absorb and equalize the shocks due to the inertia or momentum of the fluid mass when the driving force acts irregularly or the column is arrested suddenly. The shock or "water-hammer" (q.v.) is absorbed by the air-spring of a chamber on the suction-pipe to a pump, when the water flows to the pump under a head. Such an air-chamber is often and improperly called a "vacuum chamber."

Air-compressor. Machine by which a volume of air at atmospheric pressure is forced into a much smaller volume at higher pressure. The air becomes heated by the work of compression, and the heat is eliminated either by a water-jacket on the compressing cylinder or by injecting water directly into the air. Compressors are driven directly by steam, the compressing piston being on the prolongation of the rod which carries the steam piston of an engine, or else are driven indirectly by belt or gearing from the source of power. Usual pressure of air for rock-drills, etc., 60 lbs. to the square inch. The most frequent uses for compressed air are for driving rock-drills and other tunneling or underground machinery, for riveters for bridge and boiler work, in continuous train-brakes, and for displacing fluids in breweries and other works.

Air-engine. Using the elastic tension of air as source of power. The air must be first compressed to a high tension, and will then be used partly by expansion in the cylinder of this engine. The air can be carried a considerable distance in pipes, so as to avoid the inconveniences of escaping steam and of products of combustion in contracted spaces underground, etc. It is impossible to carry expansion very far on account of the low temperature of the exhaust, which would be enough to freeze any moisture in the air and clog the engine. The combined efficiency of the compressor and air-engine is less than 40 per cent when the compressed air is cooled between the two machines to the temperature of the surrounding air and objects.


Air-lock.

At Vincennes, near Paris, on a passenger tramway 12 miles long, an air-engine is used, the air being compressed at the ends of the line, and carried in steel cylinders beneath the cars. The pressure is 45 atmospheres. The low temperature of expansion is obviated by injecting hot water. Ericsson's hot air engine for light powers, three or four horse powers, has been successfully used. The furnace is within the cylinder. Tests made in Paris showed that it consumes nine lbs. of coal per horse power, twice as much as a good steam engine.

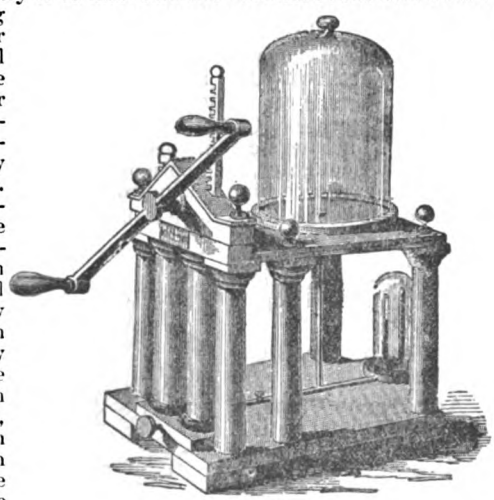
Air-gun. Invented by Guter of Nuremberg ab. 1656.

Air-lock. Chamber having two doors, one opening into a caisson or compartment containing compressed air, and the other communicating with the outer atmosphere. The outer door being open, workmen enter the air-lock; it is then closed and the compressed air slowly admitted until the inner door can be opened, when the workmen enter the caisson. The greatest air pressure in which men can work is ab. 45 lbs. per sq. inch above the atmosphere, corresponding to a depth of about 100 feet below the water surface. The figure shows a pneumatic pile with an air-lock at the top.

Air Plants. See EPIPHYTES.

Air-pump. For displacing air, or exhausting the air from closed vessels. Invented by Otto von Guericke of Magdeburg ab. 1650. Many small air-compressors would be called air-pumps.

In a condensing steam-engine, the air-pump is an essential organ, whose duty is to maintain the vacuum in the condenser. It is a lifting pump, the lower end of the barrel being below the level of the floor of the condenser and separated from it by the foot-valve. When the bucket rises and the water in the condenser and in the pump barrel has equally low pressures upon it, it passes by gravity into the pump through the foot-valve, together with any air which may have come in. When the bucket descends the foot valve closes, and the water and air pass up through the bucket-valves to be lifted and discharged to the hot-well. The pump is single-acting, and usually of $\frac{1}{8}$ the volume of the steam


Air-pump.

cylinders. With jet-condensers, the barrel and bucket are usually of brass-composition.

Air Resistance. Resistance of the air to an object moving through it, approximately proportional to the area of the surface and to the square of the velocity. Smeaton's formula, much used in general discussions, is $R = 0.005\ S\ V^2$, in which R = total resistance, S = area of surface in square feet, and V = velocity of the moving body in miles per hour.

Air Sacs. Prolongations of the lungs of birds into different parts of the body cavity, as the interclavicular, thoracic, and abdominal; also into the bones. Analogous expansions of the tracheal breathing apparatus of insects are termed air vesicles.

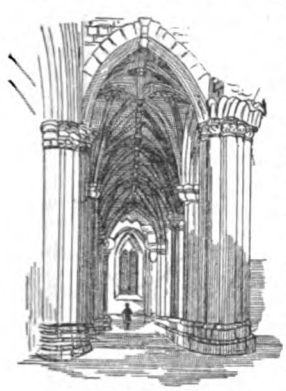
Air-Ship. Much experimentation and considerable progress has been made toward air-transportation, but no navigable balloon, flying- or other air-machine has yet been perfected which is sufficiently reliable to effect the revolution of warfare, which such an accomplishment would cause. Maxim's flying-machine is the most promising of the many tried: the French balloon, "La France," has attained a speed of 15 m. an hour under favorable atmospheric conditions.

Air Thermometer. See GAS THERMOMETER.

Air Valve. Allowing the escape of the air which collects in a water pipe at a high point of the line. Under certain conditions the air collects at such a place and lessens the flow of water, unless the valve be opened periodically.

Airy, SIR GEORGE BIDDELL, 1801–1892. English mathematician and astronomer. Prof. Cambridge 1826, Astronomer Royal 1835–81. *Calculus of Variations; Trigonometry; Mathematical Tracts; Mathematical Elements of Music;* and many astronomical memoirs.

Aisle. In architecture, properly, the lateral subdivision of a church, separated from the central compartment, or nave, by the piers that support the walls of the clerestory. Also, the nave, as a three-aisled or five-aisled church, properly a church with a nave and two or four aisles. There is but one five-aisled cathedral in England, that of Chicester. On the Continent such cathedrals are numerous. Chartres and Rheims have five-aisled choirs. Amiens, Milan, Noyon, Bourges, and Cologne are five-aisled throughout, while Notre Dame of Paris is seven-aisled. The most extensive subdivision of an interior by pillars in Europe is that of the Mosque of Cordova, which has nine aisles on each side of the nave. —Also, an alley or passage-way between rows of seats in a church, or audience-room of any kind, even when there is no structural subdivision.



Aisle—Melrose Abbey.

Aissé, MLLE., 1689–1727. Circassian slave, bought in Constantinople and taken to France in childhood; noted for her *Letters*, pub. by Voltaire.

Aist, DIETMAR. Austrian minnesinger of 12th century.

Aiton, WILLIAM, 1731–1793. English botanist; author of *Hortus Kewensis*, 1789. This was enlarged by his son, WILLIAM TOWNSEND, 1766–1849, who was also director of the Kew Gardens.

Aitzema, LIEUWE VAN, 1600–1669. Historian of the Netherlands 1621–68, and diplomatist.

Aix la Chapelle, or AACHEN. Ancient city of Germany, in the valley of the Werm, a tributary of the Meuse: noted for its cathedral and its hot sulphur baths. Pop., 1890, 103,470. Here, at a Congress held Oct. 1818, the Allied Powers agreed to withdraw the Army of Occupation from France.

Aix la Chapelle, TREATIES OF. 1. May 2, 1668, between France and Spain; France yielded Franche-Comté. 2. Oct. 7, 1748, between Great Britain, France, Holland, Germany, Spain and Genoa; confirmed the treaties of Westphalia 1648, Nimeguen 1678–79, Ryswick 1697, Utrecht 1713, Baden 1714, the Triple Alliance 1717, the Quadruple Alliance 1718, and Vienna 1738.

Aix les Bains. Watering-place in Savoy, noted for its hot baths.

Ajax, THE GREATER. Son of Telamon, King of Salamis; bravest of all the Greeks who sailed against Troy except Achilles. Crazed by his defeat at the hands of Ulysses, he slew the sheep of the Greek army, thinking they were Trojans, and took his own life.

Ajax, THE LESS. Son of Oileus, King of the Locrians; swiftest-footed of the Greeks after Achilles; drowned on his return from Troy.

Ajowan. *Carum Ajowan*, Indian plant of the Carrot Family, whose seeds are used in enormous quantities in the manufacture of thymol.

Ajutage. Conical tube attached to an orifice to increase flow of water. Also, cylindrical tubes, and tubes with curved profiles. The theoretical discharge of water can be much increased, in some cases more than doubled, by their use. See HYDROKINEMATICS.

Aka. *Metrosideros scandens*, epiphyte of the Myrtle family, native of New Zealand.

Akbar, MOHAMMED, 1542–1605. Mogul emperor, surnamed Jalal-ed-Deen; able in war and statesmanship; conqueror of Bengal.

Akee. *Blighia sapida*, tree of the order *Sapindaceæ*, native of w. tropical Africa, cultivated in the West Indies for its nutritious fruit.

Akene. See ACHENE.

Akenside, MARK, M.D., 1721–1770. English poet. *Pleasures of the Imagination*, 1744.

Akerblad, JAN DAVID, 1760–1819. Swedish scholar, famous for his work in Runic, Coptic, Phœnician and ancient Egyptian.

Akerman. At mouth of the Dniester; ceded to Russia 1812; treaty signed Sept. 4, 1826, by which Turkey conceded to Russia navigation of Black Sea.

Akerman, JOHN YONGE, 1806–1873. English numismatist. *Catalogue of Roman Coins*, 1839; *Numismatic Manual*, 1840; *Roman Coins Relating to Britain*, 1844; *Ancient Coins, Hispania, Gallia, Britannia*, 1846.

Akiba, BEN JOSEPH, d. 135. Jewish rabbi, who taught at Jaffa, and is said to have had 24,000 pupils. Being involved in the revolt of Barchocheb, he was taken prisoner by the Romans and flayed alive.

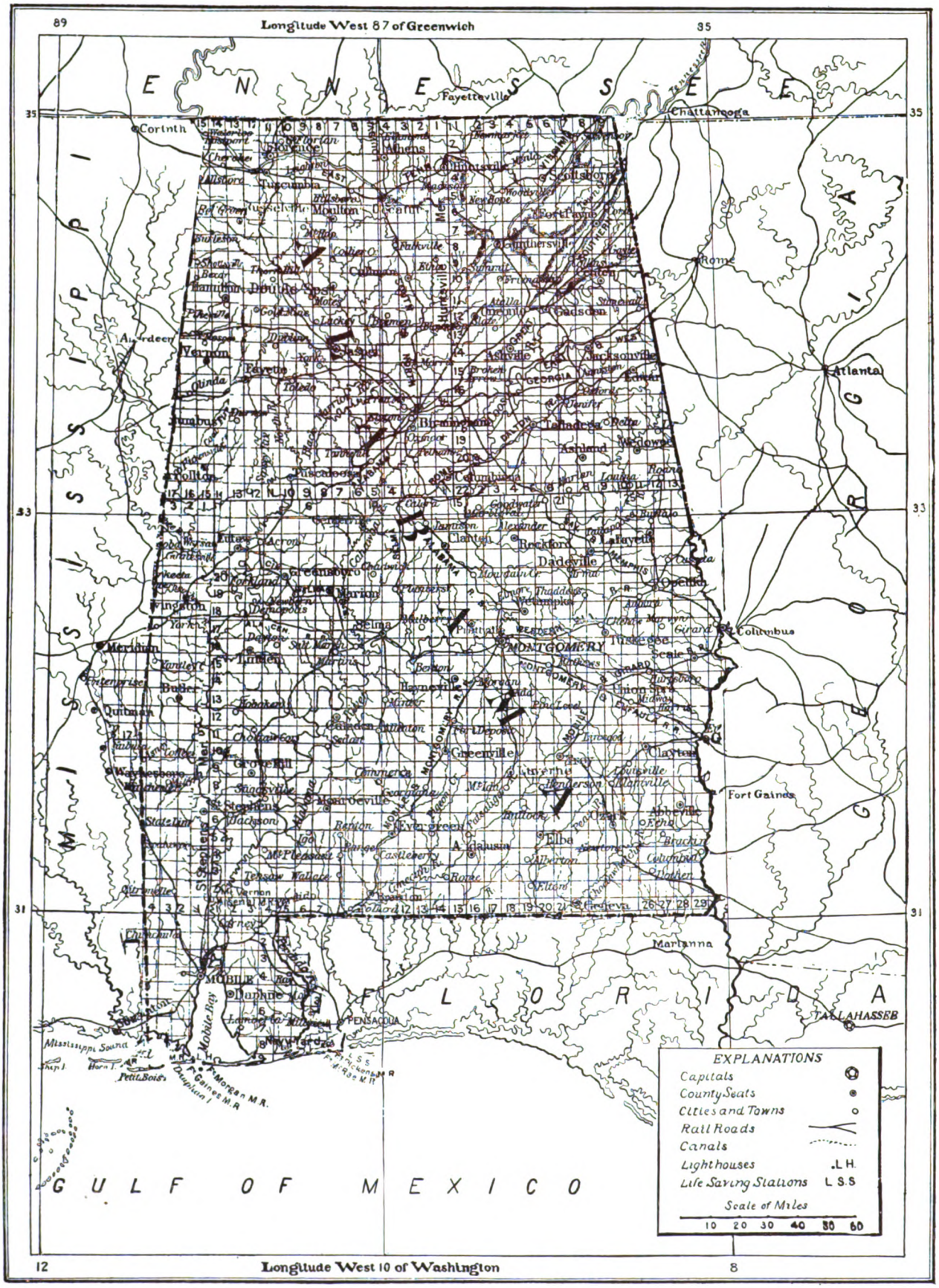
Akinetes. Non-motile cells which, becoming detached from some of the green algæ, propagate the species.

Akron. City of Summit Co., Ohio, on three railroads and the Ohio Canal. It has large manufactories of agricultural implements and stoneware. Buchtel College is located here. Pop., 1890, 27,601.

Alabama. One of the southern States, first settled by the French 1710, ceded to England 1763, admitted to the Union 1819. Its area is 52,250 sq. miles. The surface is very level, with a general increase in elevation northward. Into the northern part, however, extend the foothills of the Appalachian system, in the form of narrow ridges and broad plateaus, which diversify the surface. It is drained mainly by the Mobile River, through its two branches, the Alabama and Tombigbee, which flow from the northern part of the State southward, emptying into Mobile Bay. The Alabama is navigable to Watumpka and the Tombigbee to a point beyond the limits of the State. The geological structure is varied. Into it from the north extend the Cumberland plateau, made up almost entirely of Carboniferous formations, the Appalachian valley with its succession of Silurian and Carboniferous beds, and the upper portion of the Atlantic plain, which is composed of Archæan rocks. Around the edge of this formation, which terminates near the middle of the State, sweeps the "Black Belt" of Quarternary beds, and this is succeeded southward by the Cretaceous, the Eocene and Neocene formations with the Quarternary, forming a narrow coast strip. The industries of the State are mainly agricultural, and cotton is the leading crop, to which all other interests are subservient. The value of farms in 1890 was $111,051,390, of agricultural products in 1889 $66,240,190, and the cotton crop in 1891 was 1,060,000 bales. The commerce of the State is centered in the city of Mobile, and consists chiefly of shipments of cotton. In 1892 915,296 tons of pig iron were produced. Manufactures are rapidly increasing. The mileage of railroads in 1891 was 3,611. Pop., 1890, 1,513,017, nearly one-half colored; density of population was 29.2 per sq. mile. The capital is Montgomery, on the Alabama River, near the center of the State. (See Map on next page.)

Alabama River. In Ala. and Ga. Large left-hand branch of Mobile R., heading in the s. end of the Appalachian Mountains. Drainage area 23,820 sq. m.; length ab. 300 m.

Alabama, THE. Confederate cruiser during the Civil War, which made serious havoc in the commerce of the North; built at Birkenhead 1862, and commanded by Capt. Semmes. She captured in two years 65 vessels, and destroyed $6,000,000 worth of property. She finally joined battle with the U. S. ship *Kearsarge*, off Cherbourg, France, where she had put in for repairs, and was soon disabled and sunk, June 19, 1864. The fact of her being built and fitted out in England occasioned bitter feeling and complicated relations, involving delicate points in international law; they were finally adjusted by the Geneva Convention of 1872, which rendered a decision in favor of the U. S. See GENEVA ARBITRATION.


Longitude West 87 of Greenwich
Longitude West 10 of Washington
TENNESSEE
MISSISSIPPI
GEORGIA
FLORIDA
GULF OF MEXICO
Corinth
Tuscumbia
Florence
Athens
Huntsville
Decatur
Fayetteville
Chattanooga
Rome
Atlanta
Columbus
Fort Gaines
Marianna
TALLAHASSEE
Jasper
Birmingham
Tuscaloosa
Selma
MONTGOMERY
Eufaula
Greenville
Troy
Opelika
Lafayette
Talladega
Gadsden
Anniston
Jacksonville
Ashville
Centreville
Demopolis
Marion
Meridian
Quitman
Grove Hill
Butler
Linden
Camden
Evergreen
Brewton
Andalusia
Elba
Abbeville
Eufaula
Union Springs
Tuskegee
Clayton
Henderson
Louisville
Wetumpka
Prattville
Clanton
Columbiana
Ashland
Wedowee
Oxford
Jacksonville
Piedmont
Centre
Rome
Summerville
Scottsboro
Guntersville
Fort Payne
Russellville
Moulton
Tuscumbia
Florence
Sheffield
Tuscumbia
Iuka
Corinth
Pontotoc
Aberdeen
Vernon
Fayette
Columbus
Starkville
Macon
Meridian
Enterprise
Quitman
Butler
Linden
Demopolis
Marion
Selma
Montgomery
Greenville
Troy
Opelika
Lafayette
Talladega
Gadsden
Anniston
Jacksonville
Ashville
Centreville
Evergreen
Brewton
Andalusia
Elba
Abbeville
Eufaula
Union Springs
Tuskegee
Clayton
Henderson
Louisville
Fort Gaines
Marianna
TALLAHASSEE
MOBILE
Mobile Bay
Mississippi Sound
Dauphin I.
Petit Bois I.
Chandeleur Is.
PENSACOLA
Pensacola Bay
Perdido Bay
Fort Morgan M.R.
Fort Gaines M.R.
Fort Pickens M.R.
Fort Barrancas M.R.
EXPLANATIONS
Capitals
County Seats
Cities and Towns
Rail Roads
Canals
Light houses .L.H.
Life Saving Stations L.S.S.
Scale of Miles
10 20 30 40 50 60

Alabama, UNIVERSITY OF. At Tuscaloosa; chartered 1820; organized 1831; buildings burned by U. S. troops during the Civil War; rebuilt 1868. It has 20 instructors and 220 students, an endowment of $300,000, and 11,000 vols. in library; the curriculum includes military science and tactics.

Alabandite. Rare mineral compound of manganese and sulphur.

Alabaster. $CaSO_4.2H_2O$. Soft, fine-grained, snow-white or delicately tinted variety of gypsum, quarried near Leghorn, Italy; stone of excellent quality for vases and other ornaments. That of the ancients was a firm, compact, somewhat opalescent stalagmite (see CALCITE), now sometimes called Egyptian or Oriental alabaster; one of its best-known localities was near Thebes.

Aladdin. In the *Arabian Nights*, builder of a palace by aid of the genius of a magic lamp.

Aladja Dagh, ARMENIA. Scene of a Turkish defeat by Russians Oct. 14, 15, 1877. This disaster was followed by the siege of Kars.

Alain de Lille, ab. 1114–1202. Theologian; called *Doctor universalis*. He was a Cistercian monk and a voluminous author.

Alali. Hypothetical speechless ancestors of man; *i.e.*, before grammatical language was evolved.

Alamanni, LUIGI, 1495–1556. Italian poet and dramatist, resident mostly in France.

Alamo. Fort founded in the Texan war of Independence near San Antonio, where the Texans were routed and butchered by Santa Anna, March 1836.

Alani. Allies of the Goths and Vandals in their raids on the Roman Empire. They seem to have spread over the s. part of what is now European Russia as early as 100. They were horsemen; did not till the land; dwelt in wagons; used the lasso in battle; decked themselves with the scalps of their enemies; knew no slavery, and exulted to die in battle. They were found in Gaul and Spain ab. 510, and accompanied Genseric into Africa 429. The victory of Chalons 451, where they served under Theodoric against the Huns, was nearly lost by their defection. The name soon after disappeared.

Alarçon, HERNANDO DE. Spanish navigator, who in 1540 ascertained California to be a peninsula, and sailed some distance up the Colorado.

Alarçon, PEDRO ANTONIO DE, 1833–1891. Spanish novelist of marked ability, but clerical and anti-modern in tendency. *El Sombrero de Tres Picos*, 1868; *Escandalo*, 1875.

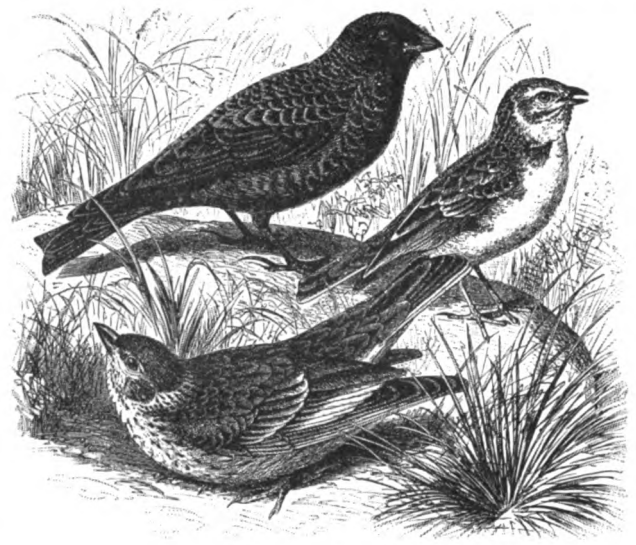
Alarçon y Mendoza, DON JUAN RUIZ DE, ab. 1590–1639. Spanish dramatist of Mexican birth. His works were reprinted 1857. One of his plays, *Suspicious Truth*, was drawn upon by Corneille.

Alaric, ab. 350-410. King of the Goths; he invaded Italy 402, conquered and sacked Rome 410.

Alary Muscles. Holding the heart to the walls of the space containing it in the back of Arthropods.

Alaska. Territory of the U. S., occupying the n. w. portion of N. America, and extending down the Pacific coast in a long narrow strip as far as lat. 54° 30′. Its area is 530,000 sq. miles. The s. portion is very mountainous, with a fiord coast, bordered by numerous large islands, between which are deep narrow channels. The Rocky Mt. system intersects the s. part with its numerous ranges, while the main axis of the range runs out in the Aleutian Islands. The n. half is mainly a great plain, containing near the coast considerable areas of tundra. The Yukon, one of the great rivers of N. America, rising in British Columbia below lat. 60, flows n. w. and then s. w. across A. to its mouth in Behring Sea. The annual mean temperature at and about Sitka, in the s. e. part, is 45°. In this part the rainfall is excessive, amounting to 82 inches annually. In the north the climate is arctic and the country uninhabitable. Pop., 1890, 31,795, all but 4,303 being Indians, Aleuts and Esquimaux. The principal productions consist thus far of furs, including the fur seal, the sea-otter, fox, etc. The country was first explored 1741 by a Russian expedition under Behring, and was occupied chiefly by a fur company. Its charter expired 1863, and in 1867 the entire territory was purchased by the U. S. for $7,200,000. It was made a county of Washington Territory in 1872, is now independent, and has been a source of revenue to the government from the fur trade. (See Map on next page.)

Alaudidæ. Family of *Passeres*, including the Larks. They have a conirostral bill, sentelliplantar tarsus, long secondaries, rudimentary first primary, sandy-brown plumage with dark longitudinal streaks, and a long, straight hind claw. More than a hundred species are included, nearly all belonging to the eastern hemisphere. The Shorelark (*Otocoris*) has a horn-like crest over each eye. The European Skylark is celebrated for its song; it sings only while flying, and can be heard when so high



Alauda yeltoniensis.

as to be invisible. It has been caught in past years, during the fall migrations, in some parts of the German Empire, by the million, being an esteemed table delicacy.

Alban, St. Protomartyr of Britain; suffered under Diocletian, between 286 and 303, at Verulamium, now St. Alban's. His day is June 22.

Albani (ALBANO), FRANCESCO, 1578–1660. Italian painter of the School of the Caracci (q.v.); associate and pupil of Guido Reni. He has important frescoes at Rome in the Palace Torlonia (formerly Verospi); others in S. Giacomo degli Spagnuoli; in Bologna, fine altar-piece in San Bartolommeo; others in the Gallery.

Albani, MME. Stage name of Marie Louise Cécilia Emma Lajeunesse, b. 1850 in Canada; operatic soprano. She became Mrs. Ernest Gye 1878.

Albania. Region between Montenegro and Greece, inhabited by descendants of ancient Illyrians, mixed with Greeks and Slavs, who live in perpetual warfare with one another; many serve as mercenaries. The people were formerly Christians, but, after death of Scanderbeg, becoming subject to the Turks, many adopted Mohammedanism. The Suliotes, in the south, were famous for their long resistance to Ali Pasha; the Mirdites, in the north, are always ready to defend their freedom and religion (R. C.) with the sword. Pop. 1,200,000. See BOZZARIS.

Albani Villa, ROME. It contains antiquarian collections made by Cardinal Alexander Albani ab. 1760.

Albanian Language. Spoken in Albania, parts of Greece and Sicily; a member of the Indo-European group, resembling in some respects the Slavonic.

Albany. Capital of New York, on w. bank of the Hudson, a few miles below the head of navigation, 145 m. n. of N. Y. city. For communication it has 5 railroads and 2 canals. It has extensive manufactures, principally of iron and steel. It was first occupied as a trading post by the Dutch 1614; actually settled 1624, when Fort Orange was built; named 1664 from the Duke of York and Albany, afterward James II.; and incorporated as a city 1686. The patroon system was introduced 1630, and partially abolished 1787. A. became the State capital 1797. The Capitol, begun 1871, 290 ft. by 390, is an imposing edifice, not yet completed, and has cost over $18,000,000. Pop., 1892, 97,120.

Albany River. In Canada, tributary to Hudson Bay.

Albatross. See DIOMIDIDÆ.

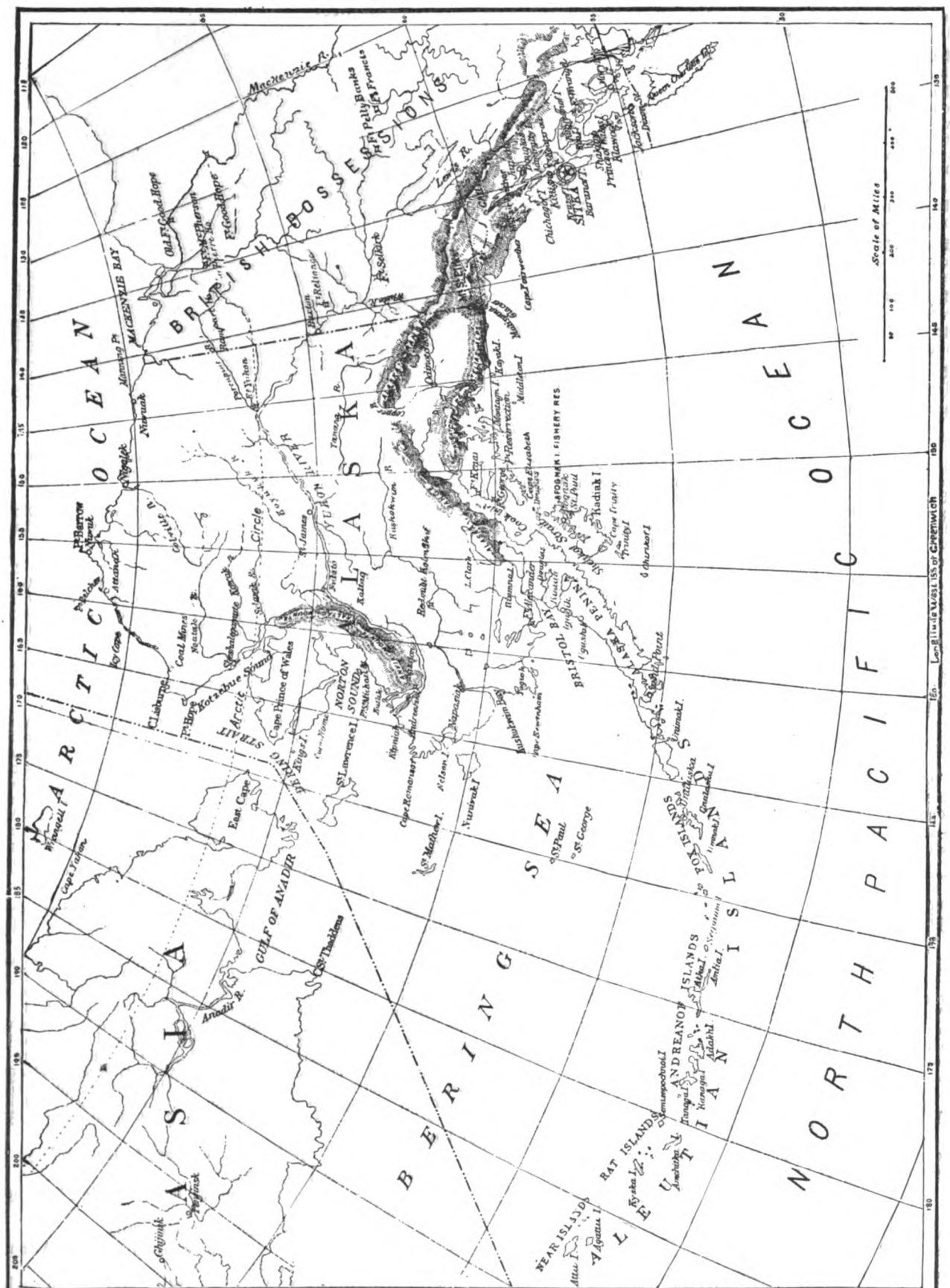
Albedo. Proportion of incident light reflected by a non-luminous body.

Albemarle, DUKE OF. See MONK, GEORGE.

Albemarle Sound. Deep indentation from the Atlantic into the coast of N. Carolina.

Alberoni, GIULIO, 1664–1752. Cardinal 1717; b. in Italy; grandee and prime minister of Spain, which he involved in great difficulties by his ambitious projects; banished 1720.

Albert I., 1248–1308. German emperor, 1298–1308; son of Rudolf I.


ARCTIC OCEAN
BRITISH POSSESSIONS
ALASKA
BERING SEA
NORTH PACIFIC OCEAN
ALEUTIAN ISLANDS
MACKENZIE BAY
YUKON RIVER
NORTON SOUND
BERING STRAIT
GULF OF ANADIR
BRISTOL BAY
ALASKA PENINSULA
FOX ISLANDS
ANDREANOF ISLANDS
RAT ISLANDS
NEAR ISLANDS
Scale of Miles
Longitude West 155 of Greenwich

Albert II. German emperor, 1438–9.

Albert, FRANCIS AUGUSTUS CHARLES EMMANUEL, 1819–1861. Prince of Saxe-Coburg-Gotha; married Queen Victoria Feb. 10, 1840; entitled Prince Consort 1857; patron of science and art, and prudent adviser of the queen. The Exhibition of 1851 grew out of a hint of his at a meeting of the Society of Arts.

Albert Edward, Prince of Wales and Earl of Chester, b. Nov. 9, 1841. He married Princess Alexandra of Denmark March 10, 1863; visited the U. S. and Canada 1859, Palestine 1862, India 1875–76; field-marshal in the British and German armies.

Albert Medal. British decoration for heroism in saving life.—Also distinction conferred by the Society of Arts on persons eminent in promoting arts or commerce.

Albert Nyanza. Lake in e. Africa, source of the White Nile; ab. 100 m. by 25; discovered by Sir S. W. Baker 1864, and long confounded with L. Albert Edward, s. w.

Albert, PAUL, 1827–1880. Prof. Col. of France 1878; historian of French literature.

Alberta. District in the Dominion of Canada, n. of the U. S. boundary, between British Columbia and Assiniboia; reaches on the n. to Athabasca. It is a good country for grazing, with severe winters. Area 106,500 sq. m.; Pop., 1891, 25,277.

Alberti, LEON BATTISTA, 1404–1472. Italian architect, painter, poet and musician, active in the Renaissance, and with Brunelleschi the founder of modern European architecture; called the Florentine Vitruvius. He was employed at Rome by Pope Nicholas V. in restoration and in decoration, and designed, after classic models, the Ch. of San Francesco at Rimini, his most celebrated work; St. Andrea at Mantua, one of the first of Italian domed churches; and the front of Sta. Maria Novella at Florence. He wrote books on sculpture, painting and architecture; the latter, *De Re Ædificatoria*, 1485, is the best known.

Albertinelli, MARIOTTO, 1474–1515. Florentine painter of the great period, pupil and follower of Fra Bartolommeo; best known by his fine painting in the Uffizi Gallery, Florence, of the Meeting of Mary and Elizabeth.

Albertite. Variety of asphalt occurring in deep fissures in Lower Carboniferous and other rocks, chiefly of Nova Scotia.

Albertus Magnus, 1193–1282. German Dominican, scholastic philosopher, theologian and alchemist. He was thoroughly educated in the learning of the time, and was especially familiar with the works of Aristotle and his Arabic commentators. His works were pub. in 21 vols. 1651.

Albertype. Photogelatin reproductions from nature, and from works of art, first made commercially valuable by Albert of Munich, after whom the process was named. His discovery consisted of a new method of fastening the gelatin film upon a glass plate which he used as a foundation, and it was the only method of using the gelatin film for pictorial purposes until Edwards of England devised a means of attaching the film to copper or other metals, thus making a base that was unattended by the risks and losses incidental to so friable a substance as glass, when subjected to the necessary pressure on the printing press. The Edwards invention is generally known as Heliotype, and is largely used for gelatin printing in this country and in Europe. See PHOTO-GELATIN. This process was perfected ab. 1868.

Albigenses. Sect once powerful in s. France, and named from the town of Albé. Pope Innocent III. proclaimed (1208) a crusade against them, headed by Simon de Montfort. Raymond VI., Count of Toulouse, who sympathized with them, was excommunicated and compelled to oppose his subjects with arms, and lead the army of monks and soldiers of fortune. A bloody war of extermination lasted intermittently till 1229. The Inquisition continued the process; many emigrated; Languedoc became a waste. The crusade facilitated the unification of France, but was a fatal blow to the nascent civilization of southern Europe. See DUALISM, CATHAZI and PAULICIANO.

Albinism. Production of white in organisms or organs nominally of some other color. Also, a condition resulting from the failure of the development of the pigment granules in the chromatophoral cells of the body. It occurs sporadically in probably all groups of animals, as well as in man. The resulting animal is an *albino;* e.g., white mice.

Albion. Early name distinguishing Great Britain from the islands about it. Pliny says they were together called British.

Albite. $Na_2OAl_2O_3 6SiO_2$. Mineral of the feldspar group, containing sodium as the principal alkaline element; a frequent ingredient in crystalline rocks.

Alboin, d. 574. King of the Lombards, invader of Italy 568, and founder of the Lombard dominion there; killed for forcing his wife to drink from her father's skull.

Albolite Cement. Made of carbonate of magnesia and infusorial earth. It is used for repairing ornamental stonework, and also as a fire-proof coating for timber.

Alboni, MARIETTA, 1823–1894. Most distinguished operatic contralto of the time. She made a tour of America in 1853, became Countess Pepoli 1854, and retired 1863.

Al Borâk. Shining steed with face and voice of a man, and wings of an eagle, on which Mohammed made his journeys to the seventh heaven.

Albrechtsberger, JOHANN GEORG, 1736–1809. German composer of church music, theoretician and organist; Beethoven's teacher in counterpoint 1794. *Gründliche Anweisung zur Composition*, 1790; *Sämmtlichen Schriften über Generalbass, Harmonielehre und Tonsetzkunst*, 1826.

Albright, JACOB, 1759–1808. Founder of the Evangelical Association of N. America (q.v.).

Albuera. Village of Spain, site of the defeat of the French under Soult by the British and Spanish forces under Beresford, May 16, 1811. French loss, 8,000; of the allies, 7,000.

Albumazar, 805–885. Arabian astronomer. Author of *An Introduction to Astronomy* and *Book of Conjunction;* both tr. into Latin; supposed author of a work on the *Revolution of the Years.*

Albumen. Nitrogenous substance constituting a large portion of all animal tissues, and a considerable part of many vegetable bodies; the white of egg is the most familiar example. In blood it is the main constituent of the serum. It contains carbon, hydrogen, nitrogen, oxygen and sulphur. Constitution not known. Soluble in water, coagulated by heat, thus rendered insoluble in water. In Botany, starchy material surrounding or inclosing embryo of certain seeds, serving to nourish it in germination. Such seeds are called albuminous; those devoid of this substance, exalbuminous. Also known as endosperm.

Album Græcum. Whitish hardened excrement of bone-eating animals; that of the hyena occurs fossilized in the bone caves of Europe.

Albuminates. Combinations of albumen with certain bases, iron, alkalies, etc., and probably the form in which many of them exist in the body. Also, normal constituents of the body, such as myosin, produced by the action of acids upon albumen.

Albuminiparous Gland. Spleen-shaped gland lying near the ovotestes in a snail, and connecting with the gonaduct.

Albuminoids. Bodies which resemble albumen and form the largest part of the solid portions of the body, except bones. They contain carbon, hydrogen, oxygen and nitrogen, are of unknown molecular arrangement, and important constituents of animal tissue. Among them are glue and gelatine. The term is in general applied to nitrogenous organic matter of unknown constitution, as diastase, pepsin, etc. They are necessary in articles of food on account of the nitrogen they contain. See PROTEIDS and PROTEIN.

Albuminose. Albumen rendered absorbable by action of the gastric juice, or an albuminoid acted upon by hydrochloric acid.

Albuminuria. Presence of albumen in urine, due as a rule to affection of kidneys. Usually the quantity present indicates severity of the disease. The transient forms occur after scarlet fever or surgical operations, during fevers, pregnancy, and a number of other diseases, and sometimes in health after heavy meals of nitrogenous food, cold baths, severe exercise, and mental excitement, and are generally of little moment. When constant, it is a symptom either of serious disease of the kidneys or of some grave constitutional affection. By heating a small quantity of urine in a test tube and adding nitric acid, a curdy precipitate is formed if albumen be present, and if strong nitric acid is added to cold urine so as to float on top, a white disc forms between the two when albumen is present.

Albuquerque, ALPHONSO DE, 1452–1515. Portuguese general. He served in Africa and India, where he laid the foundation for Portugal's Eastern empire; was Viceroy of the Indies 1509, captured Goa 1510, Malacca 1511, Ormuz 1515.

Alburnum. Sapwood of exogenous plants; named from its light color.

Alcæus, 7th century B.C. First Æolic lyric poet, considered by many the greatest of this class. He lived at Mitylene in Lesbos, and died in exile. Only fragments remain. Horace admired and imitated him. The Alcaic meter was named from him.

Alcala de Henares. City of Spain, 21 m. e. of Madrid, birthplace of Cervantes; pop. ab. 12,000. Its University, founded by Cardinal Ximenes 1510, and long eminent, was transferred to Madrid 1836. The Complutensian Polyglot Bible was printed here 1502–17.

Alcamo, GIULIO D'. Sicilian poet of 12th century, in the dawn of Italian literature.

Alcannin. Coloring matter occurring in root of *Anchusa tinctoria*, the Alkanet.

Alcántara. Town of w. Spain, on the Tagus. By defeating the Portuguese army here, June 24, 1580, the Duke of Alva gained Portugal for Spain.

Alcantara, ORDER OF. Spanish order of knighthood, instituted 1156 by Hadria II., king of Leon.

Alcarraza. Vessel made of porous pottery, and employed in warm climates for cooling water. The outer surface is always covered with a layer of moisture, which evaporates rapidly, thus keeping the temperature of the vessel and its contents much lower than that of the surrounding air; also called "monkey."

Alcazar Queber. Town near Fez, Africa, scene of a total defeat of the Portuguese by the Moors, Aug. 4, 1578, in which King Sebastian and most of his nobles were slain.

Alcedinidæ. Family of *Cuculi*, including the Kingfishers, of which there are 150 species, mostly old world and tropical forms. The western hemisphere has but one genus (*Ceryle*). In the old world are two types—*Alcedo*, with long scapulars, and *Halcyon*, with short. The Laughing Jackass of Australia, as large as a crow and living on small reptiles, illustrates the latter. The fish-eating kingfishers belong to the former type.

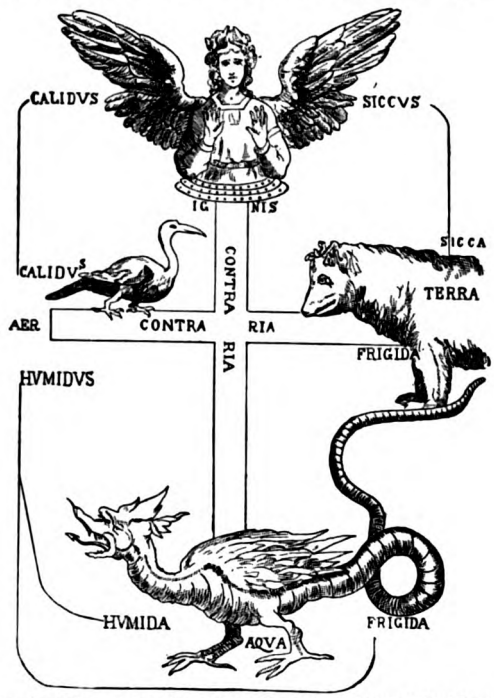
Kingfisher (*Alcedo ipsida*).

They are gorgeous in plumage, and rear their young in holes in the bank of the shore. A fable that it breeds during the reign of calms, in the subtropical ocean, has given rise to the expression "halcyon days."

Alcedinoideæ. Sub-order of *Cuculi*, including the families: *Meropidæ* (bee-eaters), *Todidæ*, *Momotidæ* (motmots), *Alcedinidæ* (king-fishers), and *Bucerotidæ* (horn-bills).

Alcestis. Wife of Admetus, who died in her husband's stead and was brought back from Hades by Hercules.

Alchemy. Delusive art, which with chemistry probably originated in Arabia, A. D. 700. The Smaragdine Table and all books attributed to Hermes Trismegistus, called the father of alchemy, were doubtless the production of monks of the Middle Ages. The alchemists believed in the transmutation of metals, and sought for the Philosopher's Stone, which would convert base metals into gold and silver, and the Elixir of Life, to prolong human existence. They worked in the utmost secrecy and with many mysterious books, most of which contained much incomprehensible and, to the scientist of the present day, nonsensical matter. These writings are in many languages—Arabic, Greek, Persian and Latin. The sources of knowledge of the early alchemists were the writings of Aristotle, Dioscorides, Lucretius, Archimedes, Hero and Pliny. Arabia was the seat of learning; the University of Bagdad in the 9th century, Cordova and Cairo in the 10th, were centers. Geber wrote one of the first works on alchemy. He had many chemical appliances, understood distillation and filtration, and made a number of chemical preparations. Among the more noted alchemists are: Avicenna, 11th century; Albertus Magnus, Thomas Aquinas, Raymund Lully, Roger Bacon and Arnoldus de Villa Nova, 13th; Basil Valentine, 14th; George Ripley, 15th, and Paracelsus and Andrew Libavius, 16th. The last two sought

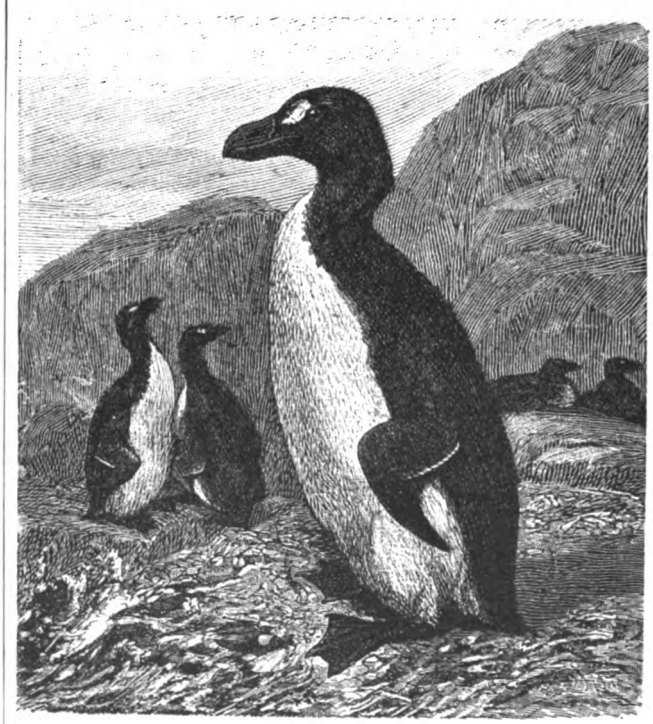


Alchemical Representation of the Transmutation of the Elements.

to free chemistry from the meshes of alchemy and mysticism. Paracelsus held the first chair of chemistry at Bale and pointed out the value of chemistry to medicine. Boerhaave, 1669–1738, was the last eminent chemist to support the doctrines of the alchemists.

Alcibiades. Ab. 450–404 B.C. Athenian, gifted but unworthy pupil of Socrates. Appointed one of the commanders of the Sicilian expedition 415 B.C., but charged with mutilating the Hermae at Athens and recalled from Sicily to stand trial, he went to Sparta and acted as enemy of Athens; took refuge with Tissaphernes 412 B.C., returned to Athens 407 B.C., and was made commander-in-chief, but superseded 406 B.C.; went into exile and was slain in Phrygia by assassins.

Alcidæ. Family of *Cecomorphæ*, including (1) the Sea Dove, or Dovekie (*Alle alle*), which swarms on rocky shores in the



Plautus impennis.

western Arctic Ocean, especially off Spitzbergen. They inhabit caves or crevices, and feed on crustacea and worms. Some are seen out at sea off the coast of the n. U. S. in winter. The sides of the head, neck and chest are sooty brown in summer, but white in winter. Sometimes called Little Auk. (2) The true Auks (*Alca*) are sub-arctic, breeding on Newfoundland and adjacent shores, and in winter come as far south as Cape Cod or farther. They grow to a length of 17 in., about twice that of *Alle*. (3) The Great Auk or Gare-fowl (*Plautus impennis*) attained a length of 30 in., and is believed to have been exterminated 1844. It had normal wing quills, but was unable to fly. Of the 76 priceless skins of this bird now known, only five are in American museums. It was known as the Arctic Penguin (see PENGUIN). (4) Murres (*Uria*) and Guillemots (*Cephus*) swarm off rocky shores in Arctic regions. Five species come south in winter as far as New Jersey. (5) Puffins (*Fratercula*). These are all alike in having three webbed toes and no hind toe, and in possessing the characters of the *Cecomorphæ*. They lay their eggs in hollows, on rocky ledges, and are an important source of food for arctic peoples.

Alcinous. Grandson of Poseidar; king of the Phæacians in the island Scheria, according to the Odyssey.

Alciphron. Ab. 170–200. Greek sophist. Many letters of his remain delineating various characters.

Alcman. Doric Greek lyric poet of 7th century B. C.

Alcmene. Wife of Amphitryon and mother of Hercules by Zeus.

Alcock, SIR RUTHERFORD, D.C.L., b. 1809. British minister to Japan 1859, and to China 1865–71. *Capital of the Tycoon*, 1863; *Art in Japan*, 1873.

Alcohol. Ethyl Alcohol, Spirits of Wine, Spirits, CH_3CH_2OH. Bpt. 78.3°C. Sp. Gr. 0.79 at 15°C. Colorless liquid produced by the action of the alcoholic ferment upon certain sugars, starches, fruit juices, etc.

In Germany it is made by treating potatoes with malt which contains the ferment, diastase. This converts the potato-starch into a sugar which when fermented yields alcohol. In America it is made from corn; in England from various grains; and in India from rice. Alcohol is the principal solvent for organic compounds; hence it is used extensively for the manufacture of perfumery, varnishes, tinctures of drugs, and for scientific purposes. Its use in various beverages is what has given it its great prominence. In order to purify alcohol it is rectified, *i.e.*, distilled a number of times or subjected to repeated distillation in one operation. The absolute alcohol of commerce contains from 0.5–0.2 per cent of water, while the so-called 95 per cent usually contains ab. 93.5 per cent alcohol. If alcohol be taken into the system in small quantities, it is absorbed by the system and disappears. In larger quantities it congests the stomach, impairs digestion and passes through the liver and kidneys unchanged, hardening and shrinking them. The most dangerous effects are upon the nervous system. It is useful to convalescents and consumptives. In acute diseases it relieves depression.

Alcohols. Combination of a hydroxyl (—OH) group or groups with a hydrocarbon group or radical. The compounds are organic hydroxides, and correspond in constitution to the inorganic hydroxides. They are acted upon by acids, usually neutralizing the acid and forming a salt. By oxidation they furnish aldehydes, ketones and acids. Examples: methyl alcohol, CH_3OH; ethyl alcohol, C_2H_5OH; and glycerine, $C_3H_5(OH)_3$.

Alcohol Engine. Designed to use the expansive force of the vapor of alcohol instead of steam in the cylinder; proposed by Edmund Cartwright 1797, and by Thomas Howard 1825–30. Alcohol was vaporized at each stroke by being injected on a surface of highly-heated oil, and after having driven the piston it was condensed on a large surface of metal, to be used again. There is no theoretical advantage in the use of alcohol vapor rather than water, and the combustibility of the material is a serious drawback.

Alcoholism. Morbid results of excessive or prolonged use of alcoholic liquors. The occasional excessive indulgence is termed acute alcoholism or inebriety. The long-continued use causes what is termed chronic alcoholism, results in severe morbid derangements or disorders of the digestive, respiratory and nervous system, and is the common cause of delirium tremens. Some are subject to a species of alcoholism which periodically induces them to great excesses in the use of liquor. A mild form of alcoholism is the habitual use of alcoholic stimulants in moderate quantities.

Alcoholometer. A hydrometer graduated to indicate the percentage of alcohol in liquors. It is made of glass, and contains a thermometer. The lowest graduations indicate the gravity of water. The presence of alcohol causes the hydrometer to sink in the liquid; by consulting the calculated tables the amount of alcohol can be determined.

Alcoholometer.

Alcolea, SPAIN. Scene of the defeat of Isabella's forces by Serrano, Sept. 28, 1868.

Alcott, AMOS BRONSON, 1799–1888. American author, "peddler, school-master, philosopher." See his Life, 2 vols., by F. B. Sanborn and W. T. Harris, 1893.

Alcott, LOUISA MAY, 1832–1888. American writer of juvenile stories; daughter of Amos B. *Little Women*, 1868; *Little Men*, 1871.

Alcuin, ab. 735–804. English scholar, who spent his later life in France as the adviser of Charlemagne. Philosophy, learning and education owe much to him.

Alcyonaria. Anthozoan polyps (often in colonial aggregates) with eight pinnate tentacles and eight mesenteric folds. In many cases they secrete a common horny axis, which they encrust with sclerodermа; usually dicœcious. There are four families: *Alcyonidæ*, *Pennatulidæ*, *Gorgonidæ*, and *Tubiporidæ*.

Alcyonidæ. Family of *Alcyonaria*, consisting of polyp stocks in close union, without axial skeleton and with a fleshy polyparium, containing but little calcareous matter.

Aldan River. Branch of the Lena, in Siberia. Length, 500 m.

Aldebaran. Star of first magnitude in constellation of *Taurus*. Sometimes called "Bull's Eye."

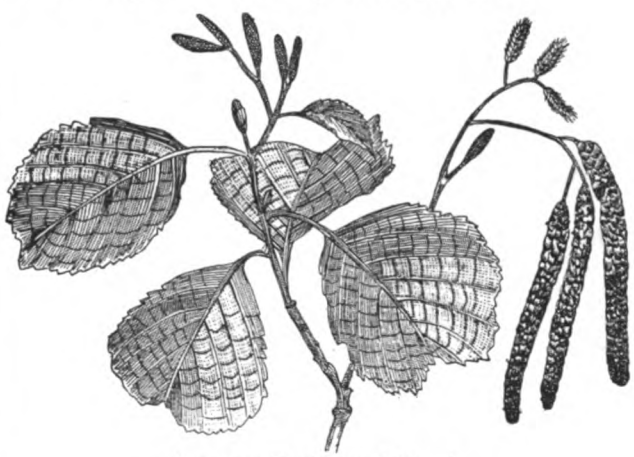
Aldegrever, HEINRICH, 1502–1558. German artist. "More conspicuous for inventive power than for noble form." He belongs to the school of wood-engravers headed by Albrecht Durer; his paintings are rare and unimportant.

Aldehyde. CH_3COH. Oxidation products prepared from the alcohols, containing the group :C—OH. By oxidation they furnish organic acids. An aldehyde may be considered as an intermediate step between an alcohol and an acid. See also ACETALDEHYDE.

Aldehyde Ammonia. $C_2H_4ONH_3$. White crystalline compound formed by combination of acetaldehyde with ammonia gas. This action is characteristic of the aldehydes as a class.

Alden, MRS. ISABELLA (McDonald), b. 1841. American author of juvenile tales. *Pansy Books.*

Alden, JOHN. One of the pilgrims who settled in Plymouth, Mass., 1620; connected with public affairs for 67 years. His story is told in Longfellow's *Courtship of Miles Standish.*



European alder (*Alnus glutinosa*).

Alder. Shrubs or trees of the genus *Alnus.*

Alder, Black. See WINTERBERRY.

Alder, White. See PEPPERBUSH.

Alderman. Official of English or American cities; originally an "elder" or nobleman.

Alderney. Channel island belonging to Great Britain, 15 m. n. e. of Guernsey; source of a famous breed of cattle.

Aldershot. Camp of 7,063 acres, 18 m. from Windsor, Eng., opened 1855 for military training and evolutions; also town, pop. over 20,000.

Aldobrandini Wedding. Small ancient fresco in the Vatican library, found on grounds of Aldobrandini Villa, near Rome. Though house-painter's work, it represents the finest

composition in painting which antiquity has left us; undoubtedly the copy of a lost and superior original.

Aldol. $CH_3.CH(OH).CH_2.CHO$. An aldehyde possessing also the properties of an alcohol and prepared by the action of hydrochloric acid upon acetaldehyde; thick liquid, soluble in water.

Aldrich, ANNE REEVE, 1866–1892. American poet and novelist. *Rose of Flame*, 1889; *Feet of Love*, 1890; *Songs about Life, Love and Death*, 1892.

Aldrich, THOMAS BAILEY, b. 1836. American poet and novelist; Ed. *Atlantic Monthly*, 1881–92. *Babie Bell*, 1856; *A Bad Boy*, 1870; *Marjorie Daw*, 1873; *Stillwater Tragedy*, 1880; *Ponkapog to Pesth*, 1883.

Aldridge, IRA, ab. 1805–1867. American actor of African descent and English training, highly esteemed throughout Europe.

Aldrovandi, ULYSSES, 1522–1607. Prof. at Bologne, 1554. *Natural History*, 1599.

Ale. Malt liquor used in England before beer was known; now differing from beer (q.v.) by its greater strength.

Aleardi, ALEARDO. Italian poet, imprisoned by the Austrians for his revolutionary zeal, 1859. His chief poems are *Le Prime Storie* (Primal Histories). His later poems are nearly all lyrical.

Alecithal. Eggs that have no yolk, but are entirely protoplasmic; small, usually microscopic.

Alecsandresen, GRIGORIE, 1812–1886. Roumanian poet and statesman. *The Year*, 1840.

Alecsandri, VASILE, 1821–1890. Roumanian poet; minister to France, 1885. *Elegics*, 1853.

Alectoropodes. Sub-order of *Gallinæ*, including the families *Tetraonidæ* (grouse), *Phasianidæ* (pheasants), *Meleagridæ* (turkeys). The group includes those *Gallinæ* or *Rasores* which have feet like a fowl, the hind toe being short and inserted high up off the ground.

Alecto. One of the furies of Eumenides.

Alectoridæ (Bustards). Family of *Grallatores*, of characters intermediate between this group and the *Gallinacei*,

Great Bustard (*Otis tarda*).

having long legs like the former and a beak like the latter. There is no hallux or hind toe. The tail is long and wings well developed; otherwise they have cursorial characters. They rarely fly; are polygamous, and confined to the Old World. See GRUIOIDEÆ.

Alectorides. See PALUDICOLÆ.

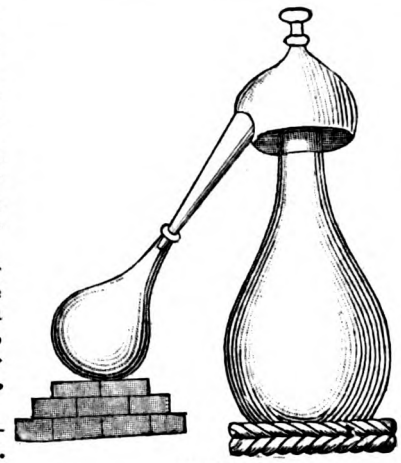
Alectoromorphæ. Order of birds including nearly all the *Gallinacei*, such as Grouse, Partridges, *Phasianidæ* and *Megapodiidæ*; or the *Alecteropodes* and *Peristeropodes*.

Aleman, MATTEO, ab. 1560 ab. 1610. Spanish novelist. His *Don Guzman d'Alfarache*, 1599, was extremely popular.

Alemanni. "All men." German tribes who lived on the Main ab. 200; defeated by Julian 357, and by Clovis 496, whereupon their union was dissolved. Hence comes *Allemand*, the French word for German.

Alembert, JEAN LE ROND D', 1717–1783. French philosopher and mathematician; editor, with Diderot, of the *Encyclopédie*. Academician, 1754. *Dynamics*, 1743; *Theory of the Winds*, 1746; *System of the Universe*, 1754–56; *Melanges*, 1759; *Opuscules Math*, 1760.

Alembic. Distilling apparatus used by the alchemists. It has been replaced by the retort, condenser and receiver.

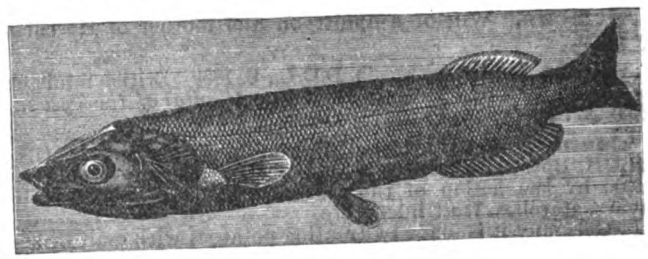


Alembic.

Alembroth Sal. See SAL ALEMBROTH.

Alencar, JOSE MARTINIANO D', 1829–1877. Brazilian novelist. *Iracema*, *Disa*, *Luciola*.

Alepocephalus. Genus of fishes having no scales on the head. German "black glass-head."



Alepocephalus niger.

Aleppo. City of Syria, formerly one of the chief of Asiatic Turkey; important commercially; partly destroyed by earthquake, 1822. Pop. ab. 100,000.

Alerse. Chilian name for a large tree of natural family *Coniferæ*; *Libocedrus tetragona*, highly valued for its timber.

Alesia. Fortified town of the Mandubii on Mt. Auxois, in Gaul; taken and destroyed by Cæsar 52 B. C., and by the Normans 864.

Alessandria. City of n. Italy, founded 1168; noted for its citadel, strengthened by Napoleon I. Pop. ab. 31,000.

Alethopteris. Genus of very large ferns, found in the lower coal measures.

Aletsch. Largest Swiss glacier, over 12 m. long.

Aleurone. Substance which occurs in seeds and more rarely in other vegetable organs, consisting of grains of nitrogenous organic substance, or proteid.

Aleutian Islands. Group of ab. 150 in N. Pacific, stretching from peninsula of Alaska, through 25° of longitude, nearly to Kamtchatka; discovered by Behring 1728; volcanic with little vegetation; some of them active volcanoes. The seal, sea-otter and Arctic fox are found here. They belong to the U. S.

Aleuts. Indians of the Aleutian Islands and adjacent lands; those living in Alaska are the Unalaska. Ab. 4,000 in all. They are closely related to Eskimos; are Mongolioid; depend on seal-fishing, utilizing every part of the animal. Their homes are burrows, with two rooms, a kitchen and a bed-room. They are noted for their gentleness and integrity; but when angered are uncontrollable. Many have been converted to the Russian Church. The Unalaska have adopted some of the comforts of civilized people.

Alewife. See ISOSPONDYLI and CLUPEIDÆ.

Alexander, THE GREAT, 356–323 B. C. Son of Philip II. of Macedon; educated by Aristotle. He aided largely in gaining the victory of Chæronea 338; ascended the throne 336; speedily crushed rebellion at home and in Greece; started on his expedition against Persia 334; traversed Asia Minor; defeated Darius at Issus 333, took Tyre 332; founded Alexandria; utterly crushed the Persians near Arbela, Oct. 331; from 330 to 327 was occupied in pursuit of Darius and conquest of regions to e. and n.; invaded India 327, and pushed to the Hydaspes; his army refusing to go further he proceeded down the river, reaching the Indian Ocean 326 and Susa 325; in spring of 324 returned to Babylon, which he intended to make his

capital; was seized by a fever and died, after 11 days' illness, without designating a successor.

Alexander I. Bishop of Rome ab. 109–119.

Alexander II. (Anselmo Badagio). Pope 1061–73. He assisted William the Norman to conquer England.

Alexander III. (Rolando Ranuccio Bandinelli). Pope 1159–81. He supported and canonized Thomas à Becket, excommunicated Frederic Barbarossa, and steadfastly opposed the Hohenstaufen pretensions in Italy.

Alexander IV. (Rinaldo di Anagni). Pope 1254–61; was involved in quarrels with the Emperors.

Alexander V. (Pietro Filargi). 1339–1410. Pope 1409–10. Broke faith with the Council of Pisa, which elected a second antipope.

Alexander VI. (Roderigo Lenzuoli Borgia), b. in Spain 1430–1503. Pope 1492–1503; Archbishop of Valencia 1455, Cardinal 1456; a man of singularly evil life, notorious for his vices; father of Cæsar and Lucretia Borgia.

Alexander VII. (Fabio Chigi), 1599–1667. Pope 1655–67. He opposed the Jansenists and was defeated in a war with France.

Alexander VIII. (Pietro Ortoboni). 1610–1691. Pope 1689–91. He helped Venice in a war against the Turks, and condemned the Jesuit tenet as to venial sins.

Alexander I. (of Scotland). 1078–1124; R. 1107–24. II., 1198–1249; R. 1214–49. III., 1241–1286; R. 1249–86.

Alexander I., 1777–1825. Emperor of Russia 1801–25; son of Paul I. He sought to promote education, commerce, unity and patriotism; abolished many abuses; joined the coalition against Bonaparte 1805; was forced to unite with Prussia in the Peace of Tilsit 1807; declared war against England 1809, from whose ally, Sweden, he took Finland; turned against Napoleon 1812–15; founded the Holy Alliance with Austria and Prussia 1816. Dread of revolution led him to aid Austria at the Congresses of Troppau, Laybach and Verona in crushing out the efforts of the nations toward political progress. Popular discontent with war burdens led to his later repressive measures. He was succeeded by Nicholas I.

Alexander II., 1818–1881. Son of Nicholas. Czar 1855. March 3, 1861, he proclaimed the emancipation of the serfs, 23,000,000 in number. In 1865 he established elective representative assemblies in the provinces. He declared war with Turkey, 1877. After repeated attempts on his life by the Nihilists, which led to stringent measures, he was killed by a bomb in St. Petersburg, Mar. 13, 1881.

Alexander III., 1845–1894. Emperor of Russia 1881–94; second son of Alexander II. and Maria of Hesse Darmstadt. He married, 1866, Maria Sophia Frederica Dagmar, of Denmark, sister of the Princess of Wales and of the King of Greece. The salient features of his reign were the repression of Nihilism, the development of Russia as a military power, and preparation for the ultimate control of Constantinople.

Alexander (Joseph), of Battenberg, 1857–1893. Prince of Bulgaria 1879–86. He defeated Milan of Servia 1885, and was expelled by Russia.

Alexander, the Ætolian. Alexandrian Greek poet of 3d century B. C. He wrote much, but only fragments remain.

Alexander, Archibald, D.D., 1772–1851. American theologian and educator; first professor of Princeton Theol. Sem., 1812. His sons followed closely in his footsteps. James Waddell, D.D., 1804–1859, was professor at Princeton, 1849–51, and pastor in New York. Joseph Addison, D.D., 1809–1860, was also professor in Princeton Seminary from 1838, and wrote several commentaries.

Alexander, William, D.D., D.C.L., b. 1824. Bishop of Derry and Raphoe from 1867; theologian and poet. *Witness of the Psalms to Christ* (Bampton Lectures), 1877.

His wife, Cecil Frances (Humphreys), b. 1823, has published many hymns and poems.

Alexander, William, D.D., b. 1831. Pres. San Francisco City College, 1871–74, and professor Theol. Sem. there since 1871.

Alexander, William Lindsay, D.D., 1808–1884. Scottish divine and educator.

Alexander of Hales, d. 1245. English Schoolman, "*doctor irrefragabilis.*" A Franciscan monk, he taught in Paris, and was the first comprehensive Aristotelian. *Summa Theologiæ.*

Alexander Severus, ab. 205–235. Roman emperor 222–235; of exemplary character, cultivated tastes, and liberal opinions; murdered by Maximin, his successor.

Alexanders. Coarse plant of the carrot family, *Smyrnium Olusatrum*, formerly used instead of celery.

Alexandra. Jewish princess, widow and successor (106 B. C.) of the Maccabean king, Aristobulus I.

Alexandra, Caroline Marie Charlotte Louise Julie, b. 1844. Daughter of Christian IX. of Denmark, Princess of Wales 1863.

Alexandra Nyanza. Lake of Central Africa, on upper waters of the White Nile.

Alexandria. City and seaport of Egypt, founded by Alexander the Great 332 B. C. It soon became the capital of the Ptolemies, and one of the most magnificent cities in the world, famous for its commerce, its schools of philosophy, its library (the largest in the world), its museum, the temple of Serapis, and the lighthouse near by on the island of Pharos, with a population of probably 600,000, mainly Greeks and Jews. From A. D. 300 till its conquest by Omar 640 it was an influential center of Christian theology. From this time the city declined, and its fall was accelerated by the founding of Cairo 969 and the discovery of a new route to the East by Cape of Good Hope 1497. Modern A. stands mainly on what was the island of Pharos and the ancient dyke which connected it with the mainland. A railway joins it with Cairo and Suez, and a canal with Cairo. Its commerce is extensive. Pop. ab. 227,000, one-fourth Europeans. The English bombarded it July 11 and 12, 1882, and reduced the best part of the city to ruins; the European quarter was burned by the natives.

Alexandria. City of Alexandria Co., Va., on the Potomac, 6 m. below Washington. Pop. 1890, 14,339.

Alexandrian Library. Founded by Ptolemy II., Philadelphus (285–247 B. C.), who endowed a corps of scholars to revise, copy and arrange the collection, which in Cæsar's days amounted to 700,000 rolls. Its chief librarians, among whom were Aristarchus, Aristophanes of Byzantium, Eratosthenes, Callimachus, and others, were the first literary critics, and science of every description was studied here. The destruction of the library was begun by Archbishop Theophilus and his followers in 391 and completed by the Mohammedans in 642.

Alexandrian School. Ab. 300 B. C.—A. D. 400, at Alexandria in Egypt. It included the best thought and learning of the Jews, who here received Plato's philosophy. (See Philo-Judæus.) In later days its teachings were maintained and extended by the great Christian school in the same city, under Pantænus, Clement, and Origen. Its influence was wide and deep.

Alexandrines. Verses of 12 syllables, named probably from a French poem, ab. 1200, on Alexander the Great.

Alexandrite. $BeAl_2O_4$. Variety of chrysoberyl, emerald green in color, but exhibiting a peculiar shade of red by transmitted light; found in the Ural Mountains, and used as a precious stone. Named after Czar Alexander I.

Alexinatz, Servia. Scene of battles between Turks and Servians, Aug. and Sept. 1876. The town was captured by the Turks Oct. 31.

Alexis, 392–286 B.C. Comic poet at Athens, generally assigned to the Middle Comedy, who wrote 245 plays and is often quoted. Many plays were tr. into Latin, but only fragments remain.

Alexius Comnenus, 1048–1118. Byzantine emperor 1081–1118. He checked the Turkish conquests, and used the Crusaders as his tools to that end.

Alfalfa. *Medicago sativa*, an herb of the natural family *Leguminosæ*, native of Europe, where it is known as Lucerne; extensively cultivated in America as a forage plant. Like most leguminous plants, it is rich in nitrogenous substances, whence much of its value as a fodder. It has deep roots, and is able to stand greater extremes of drought than any other plant of its class. It thrives in most soils and climates of the s. U. S., but is mostly cultivated in the irrigated districts of the Rocky Mountain slope. It will not stand pasturing, but in good soil and under favorable conditions three and often four cuttings can be made in a season. It is sown broadcast late in spring in a well-prepared seed-bed, in land free from weeds. The young plants start rather slowly, and any large weeds should be removed by hand. The first year but a single cutting is usually made; after that it should be cut as often as it comes into bloom. Alfalfa, either green or made into hay, is nutritious and palatable, and is readily eaten by all classes of stock.

Al-farabi, Abu-Nasr Muhammed Ibn Tarkhan. Arabian philosopher of 10th century, and court physician. He classified science under six heads: language; logic; mathematics, including music and occult sciences; natural science; civil science; divine science. He assumed a Supreme Existence, infinitely good, but without distinguishing attributes.

Alfieri, Vittorio, Count, 1749–1803. Italian poet, chiefly noted for his tragedies, composed in severe style, imitative of

the Greek drama, but full of vigor and passion. *Abel; Mary Stuart; Saul.*

Alfonso I. King of Castile 1072–1109. (VI. of Leon 1065.) "The Brave." Aided by the Cid, he defeated the Moors.

Alfonso I., 1112–1185. Son of Henry of Burgundy; Count of Portugal. He defeated the Moors at Ourique 1139, assumed the title of king, captured Lisbon, and was succeeded by Sancho I., his son.

Alfonso VIII. King of Castile 1158–1214. He defeated the Moors 1212.

Alfonso X., 1226–1284. "The Wise." King of Castile and Leon 1252–82. Second known Spanish author. He wrote verses, and promoted the writing of chronicles and tr. the Scriptures, but was more successful in literature than in government, and died in exile.

Alfonso XI. King of Castile 1312–50; defeated the Moors 1340.

Alford, HENRY, D.D., 1810–1871. English poet. Dean of Canterbury 1857; first editor *Contemporary Review*, 1866–70. His edition of the Greek Testament, 1844–61, was highly valued.

Alfred, THE GREAT, 849–901. King of West Saxons 871; grandson of Egbert, son of Ethelwolf. He successfully withstood the Danes, enjoyed the titular supremacy of all England from 893, established order, founded schools, built a navy, compiled a code of laws, and tr. Boethius and other Latin works.

Algæ. Group of plants belonging to the sub-kingdom *Thallophyta.*

They are mostly aquatic, abounding in salt and fresh water. They also frequent moist ground and damp rocks, the bark of trees, the tissue of higher plants, and unite with fungi in the formation of lichens. Some forms are cosmopolitan; but, as with land plants, the various species are restricted in their distribution, being controlled by climatic conditions, substratum and depth of water.

In structure the algæ are widely various, ranging from microscopic forms to great seaweeds that ramify like trees. The plant body may be unicellular or multicellular or coenocytic, the cells being arranged in series to form filaments, or they may be united to form cell surfaces or complex structures. Many forms are free, others attached by disks or rhizoidal growths.

Among the lower forms propagation is largely vegetative. Higher forms increase by means of swarm spores, zoogonidia, naked masses of protoplasm more or less spherical, and rendered mobile by one or more cilia. After a mobile stage they come to rest, lose their cilia, become invested with a cell-wall, and develop into a new plant. The highest orders of algæ produce motionless spores.

In reproduction the algæ are as various as their forms. Here we find the simplest manifestations of sexuality, *i.e.* the conjugation of similar gametes, but in the evolution of sex the male element alone remains mobile, and in the highest forms the sexual elements are clearly distinguishable from the complex structures in which they are developed. *Vaucheria* illustrates a common method of reproduction. The male and female cells originate as short, lateral branches. The male cell, antheridum, gives rise to many biciliated spermatozoids, while the female cell, oogonium, produces an egg-cell, oosphere. A spermatozoid finds its way to this cell and fuses with it (fertilization). A new plant results from the germination of this impregnated body. Among the highest members of the algæ, the *Floridiæ*, the male elements, spermatia, are motionless and the female apparatus, procarp, is usually much complicated.

From an economic standpoint the algæ are of little importance. Sodium carbonate and iodine are extracted from the ashes of the coarser forms. The most important use of the algæ to-day is as fertilizers. Many species are edible and nutritious, from a carbohydrate analogous to starch, others are rich in gelatine.

Algaroba. Spanish-American name for species of *Prosopis*, trees of the natural family *Leguminosæ*, natives of subtropical America. The Mesquite of s. w. U. S. is *P. juliflora.*

Algaroth, POWDER OF. Mixture of oxychlorides obtained by treating antimony trichloride with hot water. The composition of this mixture is approximately represented by the formula $Sb_4O_5Cl_2$.

Algarotti, FRANCESCO, COUNT, 1712–1764. Italian poet and art critic. *Newtonian Philosophy for Ladies*, 1733. His letters are highly esteemed.

Algebra. Variously defined as Universal Arithmetic (Newton); Science of Pure Time (Hamilton); Science of Succession (De Morgan); Science of the Equation.

Its beginning is unknown. It existed early among the Greeks in its processes, though included under Arithmetic. The work of Diophantus, ab. 360, was algebraic.

Algebra came to Europeans through the Arabs, who traced it to Mohammed Ben Musa Alcherarizmi of Khiva, 9th century, who had learned from Hindoo scholars. The beginning of the analysis is now ascribed to them: Arya Bhatta, probably of the 1st century, being the earliest known author.

The early notation was meager: the value of negatives was hardly recognized, and equations of the second degree were the limit of consideration.

In 1202 Leonardo, a Pisan traveler, brought to Italy from the Arabs a knowledge of algebra. The first printed text-book was by Lucas de Burgo, 1494.

In 1505 Scipio Perrea solved an equation of the third degree. Tartales of Brescia continued the investigation, and in 1545 Cardan, prof. at Milan, published general rules for the solution of third degree equations, still known as Cardan's Method. Ferrari, his pupil, solved the equation of the fourth degree.

Meanwhile German mathematicians, working independently, improved the notation. The earliest English work is by Robert Recorde, teacher at Cambridge, who introduced the sign of equality. Vieta, Girard, and Harriot added to the processes and known relations of the science, Harriot doing more probably than any other.

In 1637 appeared the great work of Descartes; and thenceforward algebra in its varied applications made progress so rapid as to require constantly new definitions for new branches. The latter part of the 17th century was full of new developments of algebraic forms, Newton and Leibnitz, with Wallis, Barrow, Demoivre, Taylor, Stirling, Maclaurin, the Bernouillis, Roberval, Fermat, Pascal, and others pressing out along new lines.

In the 18th century there was much elaboration of previous suggestions. Toward its close La Grange and Euler made substantial advance. With the opening of the present century came Gauss, Cauchy, Jacobi, Abel, Fourier, Horner, Sturm and others. Their work Salmon, Sylvester, Cayley and others have carried forward.

The more recent development is in the branch called "Determinants." Hamilton and Grossman have introduced new elements in the discussion.

Pure algebra in its higher development becomes "The Theory of Equations."

Algebraic notation and processes, applied in different directions and under various conditions, sweep over the entire mathematical field.

Algebraic. Mathematical processes in which quantity is represented by letters and operations are indicated by signs, including all discussions except those of arithmetic and pure geometry.

Algebraic Function. One involving only the fundamental operations—addition, subtraction, multiplication, division, involution, and evolution—distinguished from "transcendental function."

Algeciras. Town in Spain, near Gibraltar; taken by the Moors 713; destroyed by Alfonso XI. of Castile 1344, after a long and famous siege. The new town was built 1760; pop. 13,000. Near it a British fleet defeated the French and Spanish, June, 1801.

Alger, HORATIO, JR., b. 1834. American author of many juvenile books.

Alger, RUSSELL ALEXANDER, b. 1836. Brevet Major-Gen. of U. S. Volunteers 1865; Gov. of Michigan 1885–87.

Alger, WILLIAM ROUNSEVILLE, b. 1822. American author. *Critical History of the Doctrine of a Future Life*, 1863; *Genius of Solitude*, 1865; *Friendships of Women*, 1867.

Algeria. French possession of northern Africa. Its area is about 150,000 sq. miles. The country is mountainous, in ranges parallel to the coast, with fertile valleys and plains near the shore. Pop. ab. 4,125,000, including ab. 300,000 Europeans. It was early settled by Numidians and Mauri; afterward conquered and colonized successively by Romans, Vandals, Arabs and Turks. The latter established a military despotism. Their piracies were a constant menace to civilization. Charles V.'s fruitless expedition against them in 1541 was followed by like unsuccessful attempts on the part of Spain, France, England and Holland. In 1708, the dey, Ibrahim, freed Algeria from the dominion of the Porte. Piracy was somewhat checked during the French Revolution, but resumed on the return of peace. The Americans defeated the Algerine fleet off Carthagena, June 20, 1815. The bombardment of Algiers by the English and Dutch followed, and a treaty was secured by which Christian slaves were released, with the promise that piracy and slavery of Christians should cease. Piracy, however, continued. Difficulties with France culminated in a three years' blockade, ending in the bombardment of July 4, 1830, and a capitulation. The French took possession and control of Algeria. Many mistakes were made, and cruelties perpetrated, in the effort to introduce French

laws and institutions. Abd-el-Kader became the leader of a "holy war" which raged for many years, with intervals of uncertain peace. Constantine was meantime subjugated by the French; Algeria was placed under a governor-general; Frenchmen and foreigners to be subject to French laws, the natives to retain their own. In Feb. 1841, Bugeaud introduced a system of warfare that brought about the surrender of Abd-el-Kader, Dec. 1847. All attempts to conciliate the Arabs proved vain. After establishment of the French republic, the military government of Algeria was abolished. The territory of the Sahara remains under military rule.

Algiers. City, seaport, and capital of Algeria. Pop. ab.75,000.

Algiers, CORSAIRS OF. See CORSAIRS.

Algodonite. Mineral compound of copper and arsenic, named from a locality in Chili.

Algol, *β* PERSEI. Variable star of short period. Ordinarily of the second magnitude, but at intervals of 2 days, 20 hours, 49 minutes, its light diminishes to fourth magnitude, occupying 4½ hours in decreasing, remaining at the minimum 20 minutes, then returning to its former brightness in 3½ hours. Right ascension, 3 h. 0 m. 57 s. Declination, 40° 31′ 38″ N.

Algology, or PHYCOLOGY. Branch of botany, treating of the Algæ, a class of the sub-kingdom *Thallophyta*. See ALGÆ.

Algoma. District of Ontario, Canada, lying between 81° and 85° W. long., and stretching from Lake Huron to Albany River. It is rich in forests, in water, and in minerals, but has few Indians, and in the eastern portion a few white settlers.

Algonkian. In geology, a group of very ancient strata lying below the Cambrian and made up of the following subdivisions: Keweenawan—Keweenan, Grand Cañon, and Llano series; Huronian—Lake Superior, Minnesota, Adirondack, Newfoundland, etc.

Algonkian time is co-ordinated with palæozoic, and the two chief subdivisions rank with Cambrian, Ordovician, etc., while the minor terms, Keweenan, etc., stand with Potsdam, Trenton, etc. At present Algonkian strata are everywhere unfossiliferous, but the abounding and varied life of the lower Cambrian forbids the belief that Algonkian time was azoic. Doubtful specimens have been discovered.

Algonquins. Indians of N. America, who inhabited the region from Lake Winnipeg to Labrador and south to the Appalachian tribes (except the Huron-Iroquois of central New York). They tilled the soil, even using fertilizers, built villages, worshiped the heavenly bodies, gave women power to decide on war and other momentous questions. The most important tribes included were: (1) Crees of n. w. Canada, 15,000; (2) Mikmaks of New Brunswick, who had a system of hieroglyphics and who still are hunters and fishers; (3) the Maine tribes; (4) several tribes of New England, now extinct; (5) the Leni-Lenapi, Mohicans of New York, Delawares, Powhatans of Virginia; (6) Shawnees, driven south by the Iroquois, now ab. 1600, scattered and civilized; (7) Illinois; (8) Sac-Fox Indians of Wisconsin, ab. 1000 in Indian Territory; (9) Pottawatomies of s. w. shores of L. Michigan; (10) Ojibways, north of L. Superior; (11) Blackfeet of Manitoba, 25,000, now in this region, including parts of Minnesota and Dakota; (12) Ottawas of Canada.

Algorism, or ALGORITHM. From the surname of Mohammed Ben Musa Alcherarizmi, an early Arabian mathematician: used to distinguish reckoning with numerals from that by the abacus; introduced among Arabs in the 9th century and adopted through them by Europeans in the 12th century.

Algum, or ALMUG-TREES. Indian trees imported by Solomon in the timber, and used for pillars of the Temple and instruments of music; probably sandalwood.

Alhambra. Palace of the Moorish kings in Granada, built 1248–1314; surrendered to Spaniards 1491.

Alhambra.

Ali, 602–661. Arabian poet, caliph 656. *Divan.* His maxims, or proverbs, were tr. 1832.

Ali Bey, 1728–1773. Mameluke chief, ruler of Egypt 1757.

Alibi. Defense in a criminal prosecution, by showing presence of the accused in another place when the crime was committed.

Alicante. Seaport of s. e. Spain, besieged by Moors 1331, and by French 1709. Pop. ab. 40,000.

Alidade. See QUADRANT.

Alien. One born out of jurisdiction and allegiance of the government and not legally naturalized. He is not entitled to political privileges, but, as a rule, in the U. S. is allowed to take and hold property and to enjoy most of the private legal rights of a citizen. An alien enemy (*i.e.* a subject of a country at war with those of his residence), although a non-combatant, may be ordered out of the country at any moment, but until so ordered, he is generally accorded legal protection.

Alien and Sedition Laws. Passed 1798, providing that the President might arrest or banish any alien whom he regarded as dangerous to the country, and punish with fine and imprisonment malicious writings against the U. S. government or Congress; never actively enforced.

Aliethmoid. Cartilage which roofs in the posterior region of the nasal cavity near the upper turbinals. See also ALINASAL.

Alimentary Canal. Tube in which all the processes necessary for digestion and absorption of food are performed; consisting of mouth, throat, œsophagus (gullet), stomach, and large and small intestines.

Aliments. See FOODS.

Alimentus, L. CINCIUS, ab. 209 B.C. Roman writer of contemporary history, praised for accuracy.

Alimony. Allowance to a wife, ordered by a court out of her husband's estate. If made to enable her to carry on divorce proceedings, it is called *pendente lite:* if made for her support upon the termination of the proceedings in her favor, it is permanent. The subject is regulated by statute generally, although the amount of alimony in any case is largely a matter of judicial discretion.

Alinasal Region. Sides and front of nasal chambers as distinguished from internasal septum or partition between the nostrils, in the cartilaginous cranium, as seen in the embryo chick and other vertebrate embryos. The alinasal cartilages are lateral, roof-like outgrowths from the septum nasi, behind the prenasal cartilage or rostrum, and are continuous behind with the aliethmoids. From this roof the scroll-like turbinals are downgrowths, the alinasal turbinals being formed in front, the inferior turbinals in the middle or interseptal region, and the superior turbinals in the aliethmoid or true olfactory region. Here also the roof sends down the antorbital plate, which forms the partition between the eye-socket and olfactory region.

Alioth. Third star in handle of "dipper," in constellation of the Great Bear; used by surveyors in establishing a meridian; the North Star, on the meridian about 24 minutes after it, and Alioth are in the same vertical line.

Aliquot Part. Such part of a number as will exactly divide it; *e.g.* 1, 2, and 3 are aliquot parts of 6.

Aliseptal Region. See ALINASAL REGION.

Alishir, AMIR, d. 861. Eastern poet. His works are extant in Turkish and Persian.

Alismaceæ. Natural family of Flowering Plants, of class *Angiospermæ*, sub-class *Monocotyledones*, comprising 16 genera and about 55 species, found in the fresh waters of the temperate and torrid zones. Commonly called the Water-Plantain Family.

Alison, ARCHIBALD, 1757–1839. Scottish divine and author. *Nature and Principles of Taste*, 1784.—His son, SIR ARCHIBALD, 1792–1868, wrote two books on the *Criminal Law of Scotland*, 1832–33, and a *History of Europe*, 1789–1815, in 10 vols., 1839–42, continued to 1852 in 6 vols. more, 1852–57. He was made a baronet 1852.—His son, SIR ARCHIBALD, JR., b. 1826, British officer, served in the Crimea, India, the Ashantee war, and Egypt, and rose to lieutenant-general 1882.

Aliwal, N. W. INDIA. Scene of a Sikh defeat by the British Jan. 28, 1846, with loss of nearly 6000.

Alizari. Commercial name of madder. The manufacture of alizarine from coal-tar has suppressed the madder-root industry.

Alizarine. $C_{14}H_8O_4$. Dioxyanthraquinone. The most important coloring matter of the madder-root, prepared for commerce from the anthracene obtained from coal-tar; used in textile coloring on account of the brilliant lakes produced by

its combination with metallic oxides, red with alumina, black with chromium oxide, etc. When cloth is dyed with alizarine it is sold as Turkey Red.

Alizarine Assistant. Mixture of sodium or ammonium salts, produced by neutralization of oil obtained by action of sulphuric acid upon castor-oil. Its constitution is disputed, but it contains salts of the oxyoleic acids. Used in Turkey-red dyeing. Called also soluble oil, sulphated oil, and alizarine oil.

Alizarine Black. Combination of NAPHTHAZARINE (q.v.) with sodium bisulphite.

Alizarine Blue. $C_{17}N_2NO_4$. Prepared from alizarine orange by the action of sulphuric acid and glycerine. Insoluble in water. Forms a blue lake with chromium oxide. The soluble alizarine blue is a combination of alizarine blue with sodium bisulphite.

Alizarine Green. See CŒRULEINE.

Alizarine Oil. See ALIZARINE ASSISTANT.

Alizarine Orange. $C_{14}H_7NO_6$. Mononitro-alizarine. Prepared from alizarine by action of nitric acid upon it. Insoluble in water, soluble in alkali. Forms an orange lake with alumina.

Alizarine Red. Shade produced by combination of alizarine, alumina, and alizarine assistant; called also Turkey red.

Alizarine Violet. See GALLEINE.

Aljubarrota, PORTUGAL. By his victory here over John I. of Castile Aug. 14, 1385, John I. of Portugal secured the independence of his kingdom.

Alkahest. The alchemists' solvent.

Alkali Blue. See NICHOLSON'S BLUE.

Alkali Green. $C_{37}H_{33}N_2SO_3Na$. See VIRIDINE.

Alkalies. Chemically, a class of substances, as caustic soda, NaOH, and caustic potash, KOH, which have the power of neutralizing acids, of changing red litmus to blue, and possess a peculiar soapy feeling when in contact with the fingers. Ammonium hydroxide and carbonate and the oxides, hydroxide and carbonates of the alkali and alkaline earth metals possess the first two qualities. Of these, sodium, potassium, calcium, and magnesium are necessary for the development and maintenance of the body, calcium being the most important and magnesium the least so. They correct undue acidity of the stomach and of the fluids of the body, as in gout or rheumatism. The oxides and hydroxides are powerful caustics and corrosives, and taken internally in sufficient quantities give rise to fatal results; the carbonates are also more or less caustic, but, except in large amount, not dangerously so.

Alkali Metals. Lithium, sodium, potassium, rubidium, and cæsium.

Alkalimetry. Process by which the strength of a given solution of an alkali is determined, by comparing it with an acid solution of known strength.

Alkaline Earths. The oxides of barium, calcium and strontium; beryllium and magnesium are sometimes included.

Alkaloids. Organic bases containing basic nitrogen; also carbon, hydrogen, and often oxygen; of very complicated structure, and largely derivatives of pyridine and quinoline; mostly of vegetable origin, with powerful physiological action; many are deadly poisons.

Alkanet. *Anchusa tinctoria*, a blue-flowered plant of the Borage family, native of s. Europe. Its roots yield the red dye with the same name. Also, *Lithospermum canescens* of N. America.

Al-Kindi, ABU YUSUF, ab. 900. "Philosopher of the Arabs." He tr. Aristotle, and wrote on the whole range of human knowledge. His works on astrology and medicine alone survive.

Alkmaar. Town in N. Holland. It successfully sustained a siege by the Duke of Alva 1573. The Duke of York was defeated here Oct. 6, 1799. Pop., 1890, 15,833. See BERGEN.

Alkyl. Simple univalent radicals derived from the paraffine or marsh gas hydrocarbons, as methyl (CH_3), and ethyl (C_2H_5).

Allah. Arabic name of God.

Allahabad. City of British India, at junction of Ganges and Jumna rivers. Once the chief residence of Akbar, it was taken by the British 1765, and ceded to them 1801. It has long been a resort of Hindu pilgrims, and is a place of growing commercial importance. Pop., 1891, 176,870.

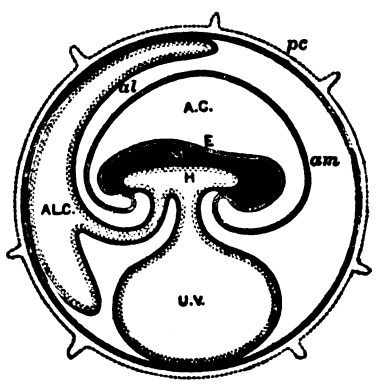
Allan Line OF OCEAN STEAMSHIPS. Established 1852 to carry passengers and mails between Canada and Great Britain. The first steamers (North American and Anglo-Saxon) had a gross tonnage of 1500. The largest was the Parisian, built 1880, 5600 gross, with compound engines.

Allanite. Mineral allied to epidote, but containing cerium, lanthanum, and didymium; found in N. J., Pa., and Greenland; named from Thomas Allan, 1777–1833.

Allantoidians. Birds, reptiles, and mammals, similar in having an allantois during fœtal development.

Allantoine. $C_4H_7N_4O_3$. Ureide of glyoxalic acid. Found in certain secretions of cows and the urine of calves.

Allantois. Leaf-shaped, hollow organ produced in the embryos of land vertebrates. It starts as a bud from the hinder end of the intestine, and spreads out between the "true" and the "false" amnion. It is in fact a hypertrophied bladder (urocyst). It serves a respiratory function in the embryos of birds and reptiles, and in mammals it also serves the function of nutrition, as it becomes the main part of the placenta. In the latter group of animals, its stalk contributes mainly to the structures of the navel string (umbilicus). The base of its stalk becomes the urinary bladder and urachus.



Fœtal Membranes of a Mammal:
E, embryo; M, its middle layer or mesoderm; H, gut-cavity lined by inner layer or endoderm; U.V., umbilical vesicle; *al*, allantois, with allantoic cavity, AL.C.; *am*, amnion, with amniotic cavity, A.C. *am* represents the united inner portion of double folds, the outer limbs of which form the sub-zonal membrane (not lettered) under *pc*, the zona pellucida. (From Turner.)

Allassotonic. Movements of mature vegetable organs, as the leaves of the various "sensitive plants" on being shocked.

Allegany Mountains. Parallel ranges running n. e. and s. w., through Pa., Md., and Va. Mean ht. ab. 2500 ft. They are a part of the Appalachian system.

Allegany River. Head branch of the Ohio, in Pa. It drains part of the Allegany plateau in western Pa., and joins the Monongahela at Pittsburg. Length 325 m.; drainage area 11,437 sq. m. It is navigable to Franklin, 123 miles above its mouth.

Allegany. City of Allegany Co., Pa., situated at the junction of the Allegany and Monongahela rivers, upon the right bank of the former, and opposite Pittsburg, which lies between them. Its industries, like those of Pittsburg, relate mainly to the manufacture of iron and steel. Pop., 1890, 105,287.

Allegany College. At Meadville, Pa.; organized 1815, incorporated 1817; controlled by M. E. Ch. since 1833. It has 15 instructors, ab. 180 students, ab. 35 of whom are women, and a library of 12,500 vols.

Allegiance. Obligation of fidelity and obedience which individual owes to the government under which he lives, or to his sovereign, in return for the protection he receives. A subject's allegiance is termed permanent, a domiciled alien's local and temporary. Modern legislation in the U. S., in Great Britain, and in some other countries permits the renunciation by a subject of his natural allegiance and its transfer to the country of his adoption.

Allegory. Extended parable; a tale, usually fictitious, wherein the persons and events symbolize spiritual ideas, as Bunyan's *Pilgrim's Progress*. St. Paul, in Galatians iv. 24, calls Ishmael and Isaac "an allegory" of the two covenants.

Allegri, ANTONIO. See CORREGIO.

Allegri, GREGORIO, ab. 1586–1652. Master of the classical Italian school of Church music. His *Miserere* for double choir, nine voices, is still performed every Wednesday and Friday in Holy Week by the choir of the Sistine Chapel. In 1770 Mozart, a boy of 14, wrote down this famous composition from two hearings, and thus compelled its publication, till then forbidden on pain of excommunication.

Allegro. Lively movement in music.

Alleine, JOSEPH, 1634–1668. English Nonconformist. His *Alarm to the Unconverted*, 1672, was long popular.

Allemande. In music, generally the first movement of the collection of pieces called a suite, though sometimes preceded by a prelude. It has only its name in common with the dance which became popular at the court of Louis XIV., or that in triple time, still popular in Bavaria, Suabia, and n.

Switzerland. The allemande of classical music is of moderate rapidity and in common time.

Allemontite. Natural alloy of arsenic and antimony.

Allen, Mrs. Elizabeth Chase (Mrs. Akers), b. 1832. American poet, writing as "Florence Percy"; author of the much-claimed song, *Rock Me to Sleep.*

Allen, Ethan, 1737–1789. Leader of Vt. troops in the War of Independence. With 83 men he captured Ft. Ticonderoga from the British, 10th May, 1775.—His brother, Ira, 1751–1814, was long connected with public affairs, and wrote a *History of Vermont*, 1798.

Allen, Grant, b. 1848. English novelist of Canadian birth. *Recalled to Life*, 1891.

Allen, Horatio, 1802–1889. Civil engineer, who operated at Honesdale, Pa., Aug. 8, 1829, the first locomotive ever run in America, and built the S. Carolina railroad 1832; pres. Am. Soc. of Civil Engineers 1873.

Allen, James Lane, b. ab. 1855. American novelist. *John Gray*, 1893; *A Kentucky Cardinal*, 1894.

Allen, Joseph Henry, D.D., b. 1820. Lecturer in Harvard Col. 1875–82; ed. *Christian Examiner*, 1857–69; *Unitarian Review*, 1887–91, and of sundry Latin classics. *Our Liberal Movement in Theology*, 1882; *Unitarian Movement since the Reformation*, 1894.

Allen, Timothy Field, M.D., b. 1837. Surgeon and botanist. *Characeæ Americanæ*, 1880.

Allen, William (also called Alan and Allyn), 1532–1594. Founder of the English college at Douay 1568, and prof. there and at Rheims 1570–85; cardinal 1587; polemic writer.

Allen, William, D.D., 1784–1868. Pres. Dartmouth Coll. 1817–19, and Bowdoin Coll. 1820–39. *American Biographical and Historical Dictionary*, 1809–32–57.

Allen Engine. Designed by John F. Allen, built 1862 in conjunction with Chas. T. Porter. The Allen valve-gear embraced the following features: 1st, giving separate and different movements to valves for admitting and exhausting the steam, so that a variable cut-off was possible with fixed release and compression; 2d, effecting this by a fixed link driven by one eccentric standing at the same angle as the crank, the cut-off varied by the position of the block in the link; 3d, the use of a double-opening valve, occupying less room than a gridiron valve; 4th, an adjustable pressure plate, resting on inclined supports, and held by the steam-pressure as close to the valve as adjusting screws will permit. The engines built by Mr. Allen and embodying these principles were not intended to run at the high speeds which were adopted by C. T. Porter. An Allen engine of 1868, still extant, was designed to run at 75 revolutions per minute.

Allen Valve. Invented by John F. Allen to distribute steam in cylinder of a steam engine; extensively used on locomotives. A channel is cast in the back of the valve over the hollow of the exhaust cavity, and the steam passes from one end of the valve through the channel into the port, which is open at the other end of the valve. The valve seat often has five parts in it. Abundant area for passage of steam into the cylinder is thus made at high speeds, without excessive movement of the valve on its seat.

Allende, Juan Rafael, b. 1850. Chilian journalist, dramatist, and poet.

Allentown. City of Lehigh Co., Pa., on west bank of Lehigh River. Pop., 1890, 25,228. It has four railroads, furnaces, iron mills, and Muhlenberg College.

All Fours. A game of cards, also called Old Sledge, Seven-Up, and High-Low-Jack, played by two or four persons playing partners, with a full pack, in which the cards rank as in whist. The points are known respectively as "High," "Low," "Jack" and "Game," each counting one, and seven being game. Six cards are dealt to each, the card following the deal being turned for trumps. If this is a Jack the dealer counts one; otherwise the Jack counts for its captor. The player on the left hand of the dealer can "beg," when the dealer must give him one point or deal three cards more to each, for a change of trump. If the same suit is turned for trump, the deal must be repeated until another suit is turned, though usually the subsequent deals are one card each. In counting for game Ace counts four, King three, Queen two, Jack one.

All-heal. See Valerian.

Allia, or Alia. Branch of the Tiber, ab. 6 m. above Rome; memorable for disastrous defeat of the Romans by Gauls 390 B.C.

Alliance. See Grand, Triple, Quadruple, Holy, and Eternal Alliance.

Alliance, Evangelical. General Protestant association, on a Trinitarian basis, formed in England 1845, with national branch alliances. It has held meetings in London, Paris, Berlin, Geneva, Amsterdam, New York, Copenhagen, and elsewhere.

Alliance of the Reformed Churches holding the Presbyterian System. Formed in London 1875; has since met in Phila., Belfast, London, and Toronto; represents 61 organizations.

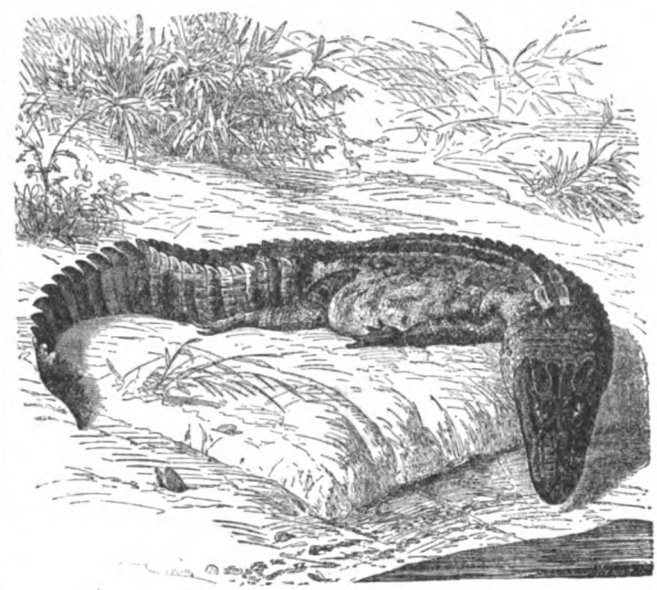
Allibone, Samuel Austin, LL.D., 1816–1889. American bibliographer. *Dictionary of Authors*, 3 vols., 1858-70; 2 v. Sup.

Alligation, Alternate. Arithmetical process which determines amount of several ingredients of different prices or qualities to produce a mixture of given value or quality.

Alligation, Medial. Arithmetical process which determines price or quality of a mixture of several ingredients whose quantity and price or quality are known.

Alligator, or Avocado, **Pear.** *Persea gratissima*, natural order *Lauraceæ*. Fruit tree of the western tropics. The fruit is pear-shaped, with soft greenish pulp, surrounding a large spherical seed, the juice of which is indelible on linen. The pulp is eaten as a salad or with claret.

Alligators. Family of *Procœlia*, including American forms, characterized by a broad snout and twenty teeth in the lower jaw (twenty-two in the Caiman of the Orinoco), fitting



Alligator mississippiensis.

into pits in the upper jaw when the mouth is shut. (The canines fit into notches.) Those in the Southern States are being exterminated. They are fond of fish, dogs, and pigs. They have a collar at the base of the tongue, which enables them to keep water from entering the windpipe while holding their prey under water to drown it. They bellow with the roar of thunder, use their tails as weapons when attacked, but are not aggressive when unmolested, while out of the water. The plates on their back are separated from those on the head, as in the crocodiles proper, which have narrower snouts; the webs of the hind toes are rudimentary. See Crocodilia and Procœlia.

Allingham, William, 1828–1889. Irish lyric poet, for some time editor of *Fraser's Magazine.*

Allioli, Joseph Franz, D.D., 1793–1873. German R. C. theologian, prof. at Munich 1826–35. His German Bible, 1830–36, based on Braun's translation of the Vulgate, received the Pope's approval.

Allioni, Carlo, 1725–1804. Prof. of botany at Turin. *Flora Pedemontana*, 1785.

Allison, William B., b. 1829. M. C. from Iowa 1863–71, U. S. Senator from 1873.

Alliteration. Agreement in two or more words, not of initial letters, but of initial accented sounds. Thus "knife" and "Nile" are alliterative words; "knife" and "kite" are not. It was the chief characteristic of early Germanic rhythm, and lingered in English poetry down to the 15th century. It is now merely an ornament, not a principle of verse.

Allix, Pierre, D.D., 1641–1717. French Reformed theologian, settled in London from 1685.

Allocution. Address made by the Pope, in Latin, to the Cardinals, on some matter of special ecclesiastical moment.

Allodial Tenure. That ownership of land which is absolutely free from feudal obligation. In most of the U. S. all lands are declared allodial, and feudal tenures are abolished.

Allœogenesis. Heterogenesis in the third sense.

Allœorgan. See ALLOPLAST.

Allogamy. Cross fertilization of flowers, the pollen from one flower acting on the pistils of another of the same species. See XENOGAMY and GEITONOGAMY.

Allogenesis. See METAGENESIS.

Allon, HENRY, D.D., 1818–1892. Pastor in London from 1844. Editor *British Quarterly Review* from 1865.

Allopathy. Name applied by Hahnemann to the school of medicine which rejected his views, on account of his belief that the remedies used by it caused symptoms different from those of the disease being treated. For some time the term was used to include all who disbelieved in homœopathy, but now it has lost its significance and is little used. Compare MEDICINE.

Alloplast. Meride composed of tissues, *i.e.*, of more than one sort of cells, among which physiological division of labor obtains; also called heteroplast.

Allopola. *Heterostaura* having the poles of the dorso-ventral axis unlike; Haeckel's promorphological term for animals having bilateral symmetry. Also called *Zeugita, Centripipeda*, etc. They are properly related to a sagittal plane rather than to a single axis. There are two groups; the *Amphipleura*, as in some of the irregular sea-urchins, and the *Zygopleura*, as in the *Vertebrata, Vermes, Arthropoda, Mollusca*, etc. The latter again constitute two groups, the *Tetrapleura* and *Deplura*.

Allori, CRISTOFANO, 1577–1621. Florentine painter of the decadence period, influenced by Bronzino; remembered for his magnificent and widely known picture of *Judith*, in the Pitti Gallery; his works otherwise inconspicuous.—His father ALESSANDRO, 1535–1607, was a well-known artist.

Allostaura. *Homopola* with biradiate symmetry, as seen in some *Sadiolaria*, e.g. *Amphilonche*.

Allotments. Small portions of land, not connected with any dwelling-house, leased to agricultural or other laborers for cultivation in addition to their other occupation, frequently by the Government, without the owner's consent.

Allotropy. Occurrence of a substance in two different forms. Carbon and phosphorus, *e. g.*, are both met in allotropic forms. Ozone is allotropic oxygen, physically denser and chemically more active than oxygen itself. Carbon occurs in three different forms; the diamond, graphite and charcoal.

Allowable Actions. Deeds inconsistent with rigid maxims of morality, and yet, judged by the condition of human nature, not to be pronounced wrong; *e. g.*, a lie told to save a friend's life must be acquiesced in, but only as an exception to the moral rule.

Alloxan. $C_4H_2N_2O_4$. Prepared by the action of nitric acid upon uric acid; large prisms soluble in water. With sulphuretted hydrogen it gives alloxantine, from which the purple coloring matter murexide used to be prepared.

Alloy. Homogeneous mixture of two or more metals. While possessing some of the characteristics of chemical compounds, they are not regarded as true chemical compounds, but rather as mechanical mixtures, though definite chemical compounds occur in some alloys.

All Saints' Day. Festival originated ab. 610, and kept in the R. C. and English Churches on Nov. 1.

All Souls' Day. Festival of the Church of Rome, begun ab. 950, and kept Nov. 2 as a day of prayer for the dead.

Allspice. *Pimenta officinalis*, small tree of the Myrtle family, extensively cultivated in the West Indies for its fruit, which is used for flavoring food.

Allspice, CAROLINA. Shrubs of the genus *Buettneria* or *Calycanthus*, natives of the southern Alleganies; also known as Strawberry Shrub or Sweet-scented Shrub.

Allspice, WILD. See BENJAMIN BUSH.

Allston, WASHINGTON, 1779–1843. American painter, poet, and novelist. *Monaldi*, 1842. In art he was West's pupil, and was supposed to resemble Titian.

Alluvium. Fine soil that has been deposited by the action of water. Alluvial soils are easily worked and in general exceedingly fertile, though this depends somewhat upon the source of the alluvium; *i.e.*, the character of the soil whence it was obtained. They are usually unhealthy locations, malarial diseases, dysentery and diarrhœa being prevalent.

Allyl Alcohol. $CH_2{:}CH.CH_2OH$. Bpt. 97°C. Hydrate of the allyl radical; liquid of suffocating odor, present in crude wood spirit, and therefore formed by the destructive distillation of wood, usually prepared by the abstraction of water from glycerine.

Allyl Compounds. Containing the unsaturated group $CH_2{:}CH.CH_2$ in combination. They unite easily with bromine.

Allylene. $CH \vdots C.CH_3$. Unsaturated hydrocarbon belonging to the acetylene series.

Allyl isosulphocyanate. $CH_2{:}CH.CH_2.N{:}S \vdots C$. Called also allyl mustard oil; liquid boiling at 151°C.; prepared by distilling black mustard seed with water. It has the pungent and distinctive odor of mustard.

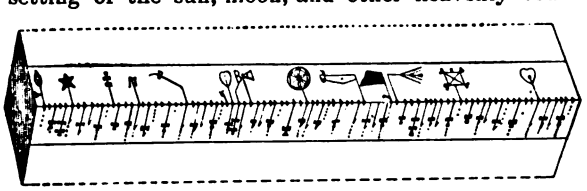
Alma. River in the Crimea; scene of a battle, Sept. 20, 1854, between the Russians, 46,000 strong, and the English, French and Turkish armies, 57,000. The Russians were routed with a loss of 5,000; the allies lost 3,400.

Almaden. Town of Spain, near the Sierra Morena, noted for its mines of quicksilver. These were worked of old by the Iberians and Romans, leased to the Fuggers of Augsburg ab. 1550, and to the Rothschilds 1843. Pop. ab. 9,000. The A. mines of Santa Clara Co., Cal., opened 1846, were named from those of Spain.

Almagest. Arabic translation of Ptolemy's *Suntaxis*, pub. at Alexandria by Claudius Ptolemy, ab. 140. A collection of problems in geometry and astronomy, now noted as containing the earliest star catalogue. It was accepted for fourteen centuries as an undisputed authority on all astronomical matters.

Almagro, DIEGO D', 1475–1538. Conqueror, with Pizarro, of Peru in 1525, afterward Pizarro's enemy and victim. His son and namesake avenged him 1541, and was executed 1542.

Almanac. Book of tables published from year to year containing a calendar of days, weeks and months, a record of various astronomical phenomena, such as the times of rising and setting of the sun, moon, and other heavenly bodies, a



English Almanac, 17th Cent., Jan. to Mch.

register of ecclesiastical festivals and saints' days. In addition to these, a great variety of matter of a historical, statistical or astrological character is sometimes added.

Almandine, or ALMANDITE. (1) Variety of spinel. (2) Variety of garnet.

Almansa. Town of s. e. Spain; scene of a decisive victory gained Apr. 25, 1707, by the French under Berwick, over the allies of Charles III., who lost most of their infantry, with artillery and baggage. Nearly all Valencia and Aragon submitted to Philip V.

Alma-Tadema, LAURENZ, b. 1836. He was b. in Friesland, studied in Antwerp, and has lived in England since 1870. As a youth he conceived a passion for Egyptian and classic archæology, and has devoted himself as a painter almost exclusively to ancient subjects, in which field he has won world-wide reputation. His forte is painstaking minuteness of detail and fidelity to archæologic memoranda. To these aims he has sacrificed vigor and breadth of effect. In spite of his rather cold and rigid methods of execution he has distinct greatness as a colorist, and in popularity and financial success is among the first modern painters. His most important work in America is *Reading Homer*, shown at the Columbian Exposition. Here were also seen, in the English Exhibit, his masterpieces, *A Dedication to Bacchus* and *The Sculpture Gallery*.

Almeida, FRANCESCO D', ab. 1455-1510. Portuguese viceroy of India 1505–8.

Almeida-Garrett, JOAO BAPTISTA D', 1799–1854. Portuguese poet and novelist; minister to Belgium 1834, ennobled 1852.

Almeria. Ancient Moorish city and seaport of Spain, on the gulf of Almeria, an arm of the Mediterranean. Pop., 1885, 38,378.

Almery. Properly, a recess or cupboard in a wall, furnished with a door; also a movable piece of furniture; used in Middle Ages and still in Italy to store the elements reserved for the Mass, and to contain the vestments of the clergy; often of stone, of considerable size and elaborately decorated.

Almohades. Dynasty of Mohammedan princes, who, from 1130, the year in which their founder died, to 1212, battle of Las Navas, ruled a vast empire, including at its height n. Africa from Tunis to the Atlantic, and Spain and Portugal as far as the Ebro and the Tagus; extinct in Spain 1257, in Africa 1269.

Almond. *Prunus Amygdalus*, small tree of the natural family *Rosaceæ*, native of w. Asia, and widely cultivated for

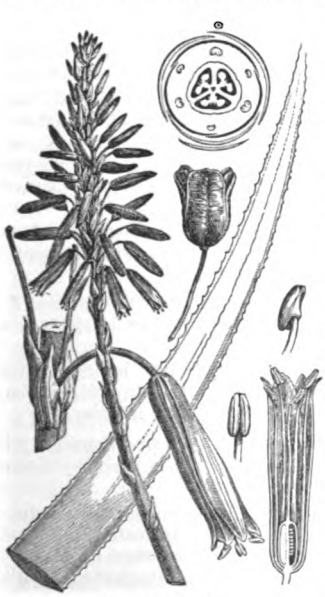
its fruit; also, in tropical America, *Goeffreya superba*, a tree of the Pea family.

Almond Oil. Sp. gr. 0.913. It is expressed from sweet and bitter almonds, and consists of olein with some stearin and palmatin. Essential oil of bitter almonds is obtained by distilling with steam the almonds, ground up with cold water. It contains prussic acid and benzoic aldehyde.

Almoravides. Family of Mohammedan princes who ruled in Africa and Spain 1073–1147; their capital was Morocco, and their empire reached from the Ebro and Tagus to the frontiers of Soudan; overthrown by the Almohades.

Almquist, CARL JONAS LUDVIG, 1793–1866. Swedish dramatist, novelist, and poet.

Almucantar. Small circle of celestial sphere parallel to horizon. Also, name given by S. C. Chandler of Cambridge, Mass., to an instrument devised by him for observing the transit of a star over such a circle. This instrument consists essentially of a telescope attached to a float placed in a trough of mercury. As the apparatus is revolved about a vertical axis, the surface of mercury being always horizontal, the line of collimation produced to the celestial sphere describes an almucantar.



Aloe socotrina.

Almucatala. Second part of the Arabian name of algebra; used by many Italian writers of the 15th century.

Aloe. Genus of plants, natural family *Liliaceæ*, the inspissated juice constituting the drug Aloes, used as a tonic and purgative. *A. socotrina* yields the best quality, named from Socotra, an island in the Indian Ocean.

Aloe, AMERICAN. See CENTURY PLANT.

Alopecia. See BALDNESS.

Aloysius de Gonzaga, ST., 1568–1591. Italian Jesuit of noble birth, victim of a pestilence at Rome while ministering to the sick; beatified 1621, canonized 1726.

Alp-Arslan, 1028–1072. Sultan of Persia 1063. He warred with the Greeks and Armenians, and took the Byzantine emperor captive 1071.

Alpaca. Domesticated VICUNA (q.v.) kept in flocks on elevated plains of Andes of Peru; in color brown, gray, or black; its wool grows eight inches in length per year, with no tendency to shed. It is only since 1840 that it has been exported for manufacture in factories. See TYLOPA.

Alpaca.

Alpha Compounds. Those in which the substitution is in a hydrocarbon group next the group which gives character to the compound; thus alphabrompropionic acid, $CH_3.CHBr.COOH$.

Alphabet. Any properly arranged list of the symbols used by a given language for its simple sounds. Our English

Alphabet is a modification of the Latin, as this of the Greek, which was based upon the Phœnician. The letters doubtless originated in hieroglyphics.

Alphæus. Disciple of Christ (some think his uncle by marriage), father of St. James the Less.

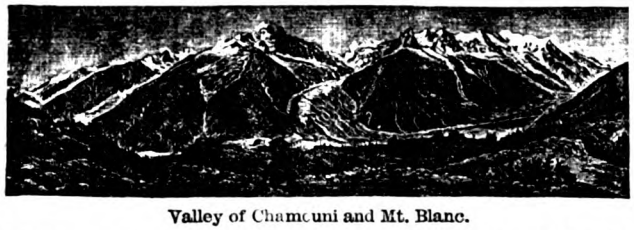
Alpheus. River of Arcadia and Elis, flowing underground a part of the way. In mythology, a river-god who pursued the nymph Arethusa under the sea to her fountain in an island near Syracuse.

Alpine Club. Association of 500 or more Englishmen, who undertake expeditions in the high Alps for pleasure and scientific advantage; founded 1858. Another, in America, dates from 1873.

Alpine Railways. Swiss mountain railways have usually a gauge of one meter (3.28 feet). On steep grades cables and rack rails are used. Railways have been built up the Eiger, Stauserhorn, and other peaks, while others are projected or under construction. Water ballast is used as a motive power in many cases.

Alpino, PROSPERO, 1553–1617. Italian botanist. *De plantis Aegypti liber*, 1592; *De plantis exoticis*, 1627.

Alps. System of mountains of s. Europe, the highest, most extensive and complicated except the Caucasus. It sweeps around the northern end of Italy in a broad curve, occupying s. e. France, all Switzerland, Italy, and s. w. Austria, to the north frontier of Turkey. The system is often subdivided as follows: the region adjoining the boundary between France and Italy, extending from the Mediterranean n. to Mont Blanc and having a n. and s. trend is in three parts, known respectively, beginning at the sea, as the Maritime, Cottian, and Graian Alps. That part east of Mont Blanc, having an e. and w. trend, is separated into two groups of ranges, a northern and a southern. The first comprises the Bernese Alps, n. of the Rhone, the Alps of St. Gall, n. w. of the Rhine, the Noric, extending from Lake Constance to the Kahlenburg in w. Austria, and the Styrian, between the Noric and the Carnic. The latter comprise the Pennine Alps, between Mont Blanc and Monte Rosa, the Lepontine, extending from Monte Rosa to the sources of the Rhine; the Rhoetian, which extend to the sources of the Piave; and the Carnian, which form the frontier between Italy and Austria. The Dinaric Alps, which extend southeast down the east coast of the Adriatic, complete the system. The highest part is in Switzerland and adjacent regions of France and Italy. Here are found Mt. Blanc, the



Valley of Chamouni and Mt. Blanc.

highest summit, 15.810 ft.. Monte Rosa, 15,208 ft., and the Finster Aarhorn, 14,026 ft. Of the passes, Monte Cenis has an altitude of 6775 ft., the Simplon 6592 ft., the Splügen 6935 ft., Great St. Bernard 8150 ft., and St. Gothard 6976 ft.

The mass of the Alps is composed of granite, gneiss, and other metamorphic rocks, with stratified beds upturned upon their flanks. The snow line is at an altitude of ab. 8900 ft., and glaciers descend to a level of 3400 ft. It is estimated that 1500 sq. miles are covered with snow and ice in these mountains.

Alquifoux. PbS. Coarse-grained galenite, sometimes called potters' ore from its being used in glazing earthenware.

Alsace. Part of ancient Gaul, held by the Romans nearly 500 years; then by Franks and French monarchs till Otho I., when it became German, and by Austria 1273–1648, when much of it was ceded to France. Louis XIV. took forcible possession of nearly all the rest. It was held by France for two centuries, and reunited to Germany 1871, except a small district.

Alsace-Lorraine. Province of the German empire, ceded by France 1871. Area, 5,668 sq. m. Pop., 1890, 1,603,506, of whom ab. one-eighth are of French origin. It sends 15 representatives to the Reichstag. More than three-fourths of the people are Catholics.

Alsatia. Sanctuary for debtors and law-breakers in Whitefriars, London, till 1697; described in Scott's *Fortunes of Nigel*.

Alsike. See CLOVER.

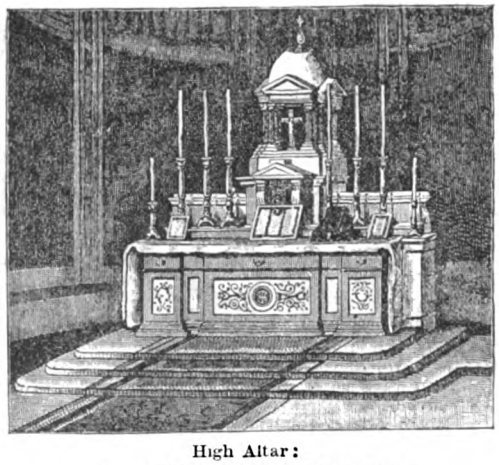
Al-Sirat. Narrow bridge believed by Mohammedans to stretch across hell from earth to paradise.

Altai Mountains. In Central Asia, between Siberia and n. w. China. Length ab. 1,000 m.; extreme ht., 12,790 ft.

Altair, α AQUILÆ. Star of first magnitude, Right ascension, 19h. 45m. 22s. Declination, 8° 34′ 32″ n.

Altamaha. River of Georgia. It rises in the foot hills of the Blue Ridge and flows s. and s. e. Drainage area 14,109 sq. m., length 155 m.

Altar. Table on which, in primitive religions, sacrifices and libations were offered. In Greek and Roman, as well as in Jewish antiquity, it had an important part in the worship of the temple. Vitruvius gives rules for the position and construction of altars, which differ in magnitude and form according to the deities to whose service they are consecrated. In Christian



High Altar:
Church of the Sacred Heart, Edinburgh.

worship, though the sacrifice became merely emblematic and typical, in Gothic architecture, the high altar became the central object of the church or cathedral, and was elaborately decorated.

Altar of Burnt-Offering. Among the Hebrews, the great altar, placed before the Tabernacle, afterward before the Temple, used for bloody sacrifices, and other oblations. In the Temple, entirely of brass, 20 cubits long, 10 high.

Altar of Incense. Among the Hebrews, made of acacia-wood, overlaid with gold, with four projecting horns, a cubit long and broad, and two cubits high. It stood in the Holy Place.

Altazimuth. Astronomical instrument used to indicate ALTITUDE (q. v.) and AZIMUTH (q. v.) of any heavenly body. The most important altazimuth is at Greenwich.

Altdorfer, ALBRECHT, 1488–1538. German painter, alderman and official architect at Ratisbon; a leader of the school dominated by Dürer. His *Victory of Alexander the Great over Darius* in Munich is one of his finest works.

Altenesch, BATTLE OF, 1234. Frisian Stedingers overpowered by 40,000 crusaders, instigated by Conrad of Marburg.

Alteratives. Group of medicines which are believed to alter condition of diseased tissues without their method of action being known. More exact methods of investigation have reduced their number. Mercury, iodine and its compounds, and arsenic, are the most prominent drugs included in this group.

Alternant. Determinant in which the elements of each row are functions of one variable and each column contains like functions of a different variable.

Alternate. In Botany, contradistinction to *opposite; e. g.*, leaves placed singly at the nodes; and, generally, petals and sepals of flowers.

Alternate Angles. Plane, spherical or dihedral; formed by a transversal with two lines or planes on opposite sides of the transversal and of the two lines or planes involved.

Alternate Function. One which changes its sign when two of its elements are interchanged; name used by Cauchy for quantities now called "Determinants."

Alternate Numbers. Formed by adding "n" numbers such that, the units of any two terms being multiplied, interchange of position of the factors changes the sign of the product. Like change of sign results with alternate numbers themselves.

Alternating Current. Succession of electric impulses in alternate directions. Such a current may be produced by the passage of a conductor to and fro through a positive or a negative magnetic field, or by the continuous motion of a conductor through magnetic fields of opposite polarities. In alternating dynamos the "frequency" may vary from twenty or thirty to many hundred in a second.

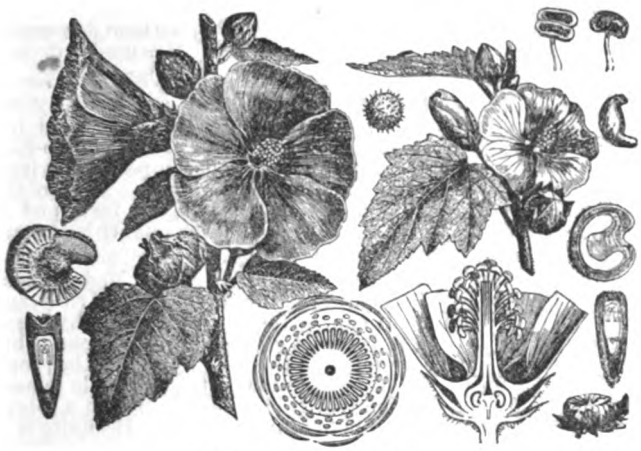
Alternation. Change of order between the second and third terms of a proportion.

If A : B :: C : D, by alternation
A : C :: B : D.

Also used, though rarely, for permutation.

Alternation of Generations. Mode of reproduction in which offspring differs from parent in mode of origin, or in form, or both, and in its turn the child produces offspring that resembles the grandparent; or the child may produce offspring like itself for several generations, but eventually the original form reappears. In the *Hydroïds* the jellyfish first appears as buds on a plant-shaped colony of hydra-like zoöids; the egg of the jellyfish produces a hydra which, by budding again and again, restores the original stock with medusa-buds on it, that are in turn detached as separate animals that reproduce sexually by means of eggs. Such a typical case presents a series of non-sexual (asexual) generations, alternating with a sexual generation. In Plant-lice, we have a series of parthenogenetic summer-generations alternating with sexed generations that appear in the fall. See PARTHENOGENESIS, AMPHIGENESIS, METAGENESIS, HYPOGENESIS and STROPHOGENESIS.

Althæa. Genus of Mallow family. The so-called Shrubby Althæa is *Hibiscus Syriacus*, a tall shrub, native of western Asia, and much cultivated; known also as Rose of Jericho. The root of Marsh-mallow, *Althœa officinalis*, is used in medicine for



A. rosea and A. officinalis.

its mucilaginous properties. A favorite preparation in **France** is the *Pâte de Guimaure*, a kind of lozenge made with mucilage of Althæa root, gum-arabic, sugar and the white of egg. *Althœ rosea* is the Hollyhock of the garden, and contains similar properties.

Altitude. Angular distance of a star above horizon, measured on a vertical circle of the celestial sphere passing through the star.

Alto. Strictly, the male voice of highest pitch in music; generally used as synonymous with contralto, the middle part in vocal harmony, sung by the low female voice. Also Italian name for the VIOLA (q. v.).

Alton. City of Madison Co., Ill., on the Mississippi, 22 m. n. of St. Louis. Pop., 1890, 10,294.

Altona. Largest city of Schleswig-Holstein, Germany; on n. bank of the Elbe, near Hamburg. Pop., 1890, 143,249.

Altoona. City of Blair Co., Pa., at e. base of the Allegany plateau. It contains the principal offices and shops of the Pennsylvania Railroad. Pop., 1890, 30,337.

Alto-rilievo. High relief or bold projection in sculpture.

Altranstädt, PRUSSIA, TREATY OF. Between Sweden and Poland; signed Oct. 4, 1706. Another, 1714, between France and Germany.

Altruism. Action or inclination prompted by the benevolent affections; desire of acting for the advantage of others, as opposed to egoism, desire of acting for our own advantage.

Alula. See BASTARD WING.

Alum. See ALUMS.

Alum, BURNT. When alum is heated, it melts in its water of crystallization. If the heat be raised, the water passes off, and the resulting product, a white voluminous mass, is called "burnt alum." Used in medicine.

Alum-root. Popular name for *Heuchera Americana*, a N. American plant of the *Saxifragaceœ*. Also, *Geranium maculatum*.

Alum Shale. Clay containing pyrite and peat; used for making ALUM (q.v.).

Alumina. See ALUMINIUM TRIOXIDE.

Aluminates. Class of compounds derived from aluminium hydroxide, $Al(OH)_3$, by replacing the hydrogen by a metal. Thus, when sodium hydroxide is added to a solution of an aluminium salt, aluminium hydroxide is first precipitated, but is redissolved in an excess of sodium hydroxide. The compound in solution is thought to be sodium aluminate, $Al(ONa)_3$. There are others of different composition, as AlO.OK; $Ca(AlO_2)_2$. The most important which occur in nature are the spinels.

Aluminium. Al. Sp. gr. 2.7. Mpt. 625° C. At. wt. 27. Discovered by Wöhler 1827. It is soluble in hydrochloric acid; it is not acted upon by nitric or sulphuric acids at ordinary temperatures; at higher temperatures action takes place and the corresponding salts are formed. It dissolves in solutions of caustic alkalies, forming aluminates. It acts both as an acid-forming and a base-forming element. It reduces many oxides when heated with them to a sufficiently high temperature; for this reason it is used in the preparation of boron and silicon. See ALUMINIUM, METALLURGY OF.

Aluminium Acetate. $Al(C_2H_3O_2)_3$. Used as a mordant in dyeing. It is usually made by treating a solution of alum with a solution of lead acetate, when lead sulphate is precipitated, and potassium and aluminium acetates remain in solution. It may also be made by treating aluminium sulphate with lead acetate. It is sold under the name of "red liquor."

Aluminium Bronze. Alloy of copper and aluminium, containing from 5 to 10 per cent of the latter. It resembles gold in color, is very hard and elastic. Ordinary reagents do not act upon it easily. It is used for cartridge-shells, gun-barrels, gun-linings, helmets, hold-down bolts for mortar batteries, propellers, and small boats.

Aluminium Chloride. $AlCl_3$. If aluminium hydroxide be treated with hydrochloric acid, aluminium chloride is formed, and crystallizes from the solution as $AlCl_3.6H_2O$. If the attempt be made to drive off the water of crystallization, the compound is decomposed, leaving alumina as a residue. To make anhydrous aluminium chloride, chlorine is passed over a heated mixture of the oxide and carbon. The chloride is volatile and is deposited in the cool part of the apparatus. When exposed to the air it attracts moisture. Aluminium chloride boils at 180° C. With sodium chloride and potassium chloride it forms double salts of the composition $AlCl_3.NaCl$ and $AlCl_3.KCl$.

Aluminium Fluoride. AlF_3. Formed by the action of silicon fluoride upon aluminium. It forms cubic crystals which are insoluble in water and resist the action of acids. With sodium fluoride it forms a double compound. See CRYOLITE.

Aluminium Hydroxide. $Al(OH)_3$. It occurs as the mineral HYDRARGILLITE (q.v.). In the laboratory it is made by treating a solution of aluminium chloride with ammonia solution; formed in this way, it is a white, gelatinous precipitate, which loses water on being heated, forming meta-aluminic acid, AlO.OH. A compound of the same composition occurs in nature as the mineral DIASPORE (q.v.). If heated higher, aluminium trioxide, Al_2O_3, is formed. In addition to these two hydroxides there is a third, $Al_2O(OH)_4$. The normal hydroxide is the starting point in the preparation of the other aluminium salts.

Aluminium, METALLURGY OF. Beauxite is the chief ore source of aluminium, and it occurs in France, in Austria, Ireland, Arkansas, Alabama and Georgia. It consists of aluminium oxide, water, iron oxide and silica, the last two as impurities. The market price varies from $6 to $10 a ton for ore containing 60 to 80 per cent of alumina, corresponding to 30 to 45 per cent of aluminium. The 900 pounds of aluminium in a ton of $10 beauxite is worth about $500, when extracted, the great difference in the values of finished and raw material representing mainly the costly process of manufacture.

Aluminium compounds are very difficult to reduce to metal, resisting all the ordinary reducing agents. The German chemist Wöhler first obtained the metal as a powder in 1827, by decomposing the chloride by potassium; it resisted all attempts to melt it. The French savant Deville first produced it in large quantities, in 1855; his method being to reduce the double chloride of aluminium and sodium by sodium. The cost of production by this process was ab. $10 per pound, and it was used exclusively up to 1885. In 1886 electrical methods began to be operated on a commercial scale, and since 1890 have entirely supplanted the sodium process. The present method is as follows: Pure alumina is first prepared from beauxite, by roasting the fine ore mixed with soda ash in a furnace, washing out the combination of soda and alumina with water, and precipitating aluminium hydroxide from this solution by carbonic

acid gas. The precipitate is filtered out, washed, dried and calcined, and is introduced into a molten bath of fused cryolite, fluorides of aluminium and sodium, which dissolves about 20 per cent of its weight of alumina. On passing an electric current through this bath only the dissolved alumina is decomposed, it being the weakest chemical compound present, while the fluorides constituting the solvent portion of the bath remain undecomposed. The operation is carried on in a wrought-iron tank, 6 feet long, 3 feet wide and 2 feet deep, lined heavily with carbon. The fluid bath is 1 foot deep, and carbon cylinders dipping into it from above form the positive electrode, while the lining of the pot forms the negative pole. The distance of the carbon cylinders from the bottom is so regulated that the heat set free by the resistance to the passage of the current is sufficient to maintain the bath in fusion without the aid of external heat. When the alumina dissolved in the bath has been mostly decomposed, the current begins to attack the fluorides, forming the solvent, and sets free irritating fumes of carbon fluoride. To avoid this, the bath is kept well supplied with alumina. The metal accumulating at the bottom of the bath is periodically bailed out with ladles. The process is thus made continuous, a pot sometimes running several months without stopping. Each pot requires an electrical tension of 5 to 8 volts to operate it, and the output averages one pound of metal per day for every horse-power employed to generate the electricity. The purity of the metal depends mostly on the purity of the alumina used, for any iron oxide or silica in it would inevitably be reduced and pass into the metal as iron and silicon. Raw beauxite is sometimes employed instead of pure alumina, to produce a low grade suitable for some purposes. The cost of production, with not over 2 per cent of impurities, is between 30 and 40 cts. a pound. The largest works in the world are at the Falls of the Rhine, Switzerland, their annual output being over a million pounds. The only works in America are at New Kensington, Pa., on the Allegany River, 18 m. above Pittsburg; their yearly output is half a million pounds. This firm is building a 6,000 horse-power plant at Niagara Falls, which will have a yearly capacity of two million pounds, and will be in operation in 1895. The present annual production in the world is two million pounds, and will probably reach double that quantity in 1895.

The color of aluminium is white with a shade of blue, especially in impure metal. Pure metal is about the same in softness and toughness as pure copper; under the knife-blade it cuts smoothly. A small proportion of impurity hardens it considerably and makes it cut gritty. In specific gravity it is by far the lightest of the useful metals, being 2.6 to 2.7; the specific heat is high, 0.222, and the melting point is 625° C., a dull-red heat. The latent heat is the greatest of any known substance, being 100 calories according to quite recent experiments; in virtue of this quantity, it takes considerable time to melt even in a hot fire. In conducting power for heat and electricity, it stands next after silver, copper and gold. In malleability it is but little inferior to gold and silver, the leaf having almost entirely displaced silver leaf; its ductility is likewise remarkable. In short, it stands in many physical properties intermediate between the noble and the so-called base metals.

Pure aluminium is, like pure gold and pure silver, soft and not strong; but, like them, it may be hardened and strengthened by judicious alloying. From 1 to 5 per cent of silver, copper, nickel, zinc, or titanium effects this improvement, raising the tensile strength 50 or 100 per cent, as the following table shows:

	Tensile strength in lbs. per sq. in.
Pure Aluminium, cast	15,000
" " sheet	25,000
" " wire	30,000
Aluminium with 2 per cent of copper, thin sheet	40,000
" " 4 " " "	44,000
" " 6 " " "	50,000
" " 8 " " "	55,000
" " 2 " of titanium, sheet	35,000
" " 5 " of nickel, castings	25,000
" " 5 " " sheet	50,000

These strong, light alloys replace the pure metal for purposes requiring hardness, strength and rigidity, such as portable instruments and vehicles of every description, etc. On account of its rapid conduction of heat, lightness and non-poisonous properties, it is the best material known for culinary utensils. The use of these is increasing with great rapidity. Several hundred tons have been used in Germany for military equipments, such as ammunition cases, bayonet scabbards, shells, and drums. A few of the many other uses are surgical instruments, boats, pontoons, torpedo tubes, bicycles, watches, chains, horse-shoes, bitts, stirrups, pen-holders, match-boxes, etc.

The most important alloys in which it is the minor constituent are those with copper, iron and zinc. Copper containing up to 10 per cent of aluminium forms the aluminium bronzes, which are fine-grained, tough, strong, and of a golden color, having the following mechanical properties:

Per cent of Aluminium	Color.	Tensile strength (lbs. per sq. in.)	Elongation (per cent)
2½	Reddish-gold.	35,000	35
5	18-carat gold.	50,000	30
7½	Green gold.	55,000	25
10	Guinea gold.	80,000	15

Aluminium-brass is ordinary brass with 1 to 2 per cent of aluminium. It is 50 per cent stronger than ordinary brass, and can be forged hot like soft iron. In the steel industry aluminium has found important application as a de-oxidizing agent, being added in small quantities to molten steel just before casting. The effect is to produce ingots or castings free from blow-holes. When added to a bath of molten zinc, such as is used for galvanizing iron, it removes oxygen from the bath, prevents further oxidation of the zinc, and causes the zinc coating on the iron to be brighter and to keep its color better. Similar applications are made of its de-oxidizing powers in the metallurgy of iron and nickel.

Aluminium is sold in three grades: "extra" is over 99.5 per cent pure; ordinary "number one commercial" is guaranteed over 98 per cent pure; and "commercial number two" is guaranteed over 95 pure and averages 96 per cent. This last quality is used in steel works; the first two are sold either in ingots for re-melting or in slabs for rolling. The prices, Feb. 1895, were 98 per cent 53 cts.; 94 per cent 50 cts. per pound.

Aluminium Nitrate. $Al(NO_3)_3$. Made by dissolving aluminium hydroxide in nitric acid. It crystallizes in the form of $Al(NO_3)_3.9H_2O$, which fuses at 73° C. without decomposition; at 100° C. decomposition takes place. It is used in dyeing.

Aluminium Sodium Fluoride. See CRYOLITE.

Aluminium Sulphate. $Al_2(SO_4)_3.18H_2O$. Made by dissolving aluminium hydroxide in dilute sulphuric acid and evaporating to crystallization, when a salt of this composition is deposited. If heated to redness, it is decomposed, leaving a residue consisting mainly of aluminium trioxide. It is soluble in 2 parts of water, has a sweetish, astringent taste and an acid reaction. It is manufactured in large quantities for use as a mordant and for sizing paper, etc.

Aluminium Trioxide, or ALUMINA. Al_2O_3. Made by heating the hydroxide. It occurs in nature in the form of ruby, sapphire, and corundum. It can be fused with the oxyhydrogen flame, and on melting it becomes crystalline. Artificial rubies and sapphires have been made in this way by adding the proper coloring matter to the fused alumina. It is insoluble in acids if it has been heated strongly. It can be obtained in a soluble form by fusing with acid potassium sulphate. Beauxite is an impure form.

Alums. Class of compounds of the type represented by common alum, potassium aluminium sulphate, $KAl(SO_4)_2.12H_2O$. Other alums may be regarded as derived from this by replacing the potassium with sodium, ammonium, rubidium, lithium, silver, cæsium or thallium. Alums are also derived from the common form by substituting for the aluminium, iron, chromium or manganese. These all crystallize in octahedra modified by cubes, and are strictly isomorphous. They are all soluble in water and possess an astringent taste. The potassium and ammonium alums are used very extensively in dyeing. The former is employed in medicine as an astringent, as a styptic, and as an application to unhealthy suppurating surfaces, especially when deprived of its water of crystallization (burnt alum); it is also emetic in large doses, and is used to relieve the colic of lead poisoning. Added to bread it whitens it, rendering possible the use of inferior grades of flour, and increases its weight by absorbing appreciable amounts of moisture. Bread adulterated in this manner is unfit for use, as the alum soon disturbs the digestion and causes constipation.

Alunite, or ALUMSTONE. $K_2Al_4SO_4.6H_2O$. Natural hydrous sulphate of aluminium and potassium, found in Italy, Hungary, and other European countries. It is a product of the action of sulphurous vapors on the rocks with which the mineral is associated. It has been used as a source of alum, which is obtained from the mineral by repeated roastings and washings. It was first observed at Tolfa, near Rome.

Alva, FERNANDO ALVAREZ DE TOLEDO, DUKE OF, 1508–1583, Spanish general of Philip II.; governor of the Netherlands 1567–73; detested for his cruelties. By his own account, he had ordered some 18,000 executions, chiefly for religious cause. He conquered Portugal 1580.

Alvarado, ALONZO. Follower of Cortez in Mexico and of Pizarro in Peru; captain-general there 1549–53.

Alvarado, PEDRO DE, d. 1541. Officer of Cortez 1518; had command in city of Mexico 1520; gov. of Guatemala 1523, and also of Honduras 1535.

Alvarez, FRANCISCO. Portuguese priest who was in Abyssinia 1515–21, and pub. an account of it 1540.

Alypius, ab. 300 B. C. Greek philosopher, interesting in the history of music for his *Introductio Musica* which has preserved the Greek system of notation.

Alypius, St., ab. 354–430. Friend of St. Augustine, baptized with him 387; Bp. of Tagaste, Numidia, 394.

Alyssum. Genus of *Cruciferæ*. The sweet *Alyssum* is *A. maritimum*, a common garden plant.

Alytes. See Bufonidæ.

Alzog, Johann Baptist, D.D., 1808–78. R. C. prof. at Posen 1836, Hildesheim 1845, and Freiburg 1853. *Ch. History*, 1840, tr. 1874–76; *Patrologic*, 1866.

Amadeus, 1845–1890. Son of Victor Emmanuel of Italy; Duke of Aosta; elected King of Spain Nov. 16, 1870; abdicated Feb. 11, 1873.

Amadis of Gaul. Oldest of the Spanish romances of chivalry. It aims to paint the character of a perfect knight, and was known in Spain ab. 1350; extant in a version by G. de Montalvo ab. 1470.

Amador de los Rios, Jose. 1818–1878. Historian of Spanish literature in 7 vols., 1861–65.

Amadou. Inflammable substance prepared in Germany from the fungus *Polyporus fomentarius*, which is beaten into a felt-like mass and mixed with saltpetre; German tinder.

Amalaric. King of Visigoths 507–531.

Amalek. Nomadic Arab tribe of the Sinaitic peninsula, hostile to the Israelites; defeated by Ehud, Gideon and Saul, and at last destroyed by David. Supposed to be, in part at least, descended from Esau.

Amalfi. City of s. Italy, plundered by the Pisans 1135, partly buried by the sea 1343.

Amalgam. (1) Metallic alloys of which mercury or quicksilver is constituent. This property of mercury of combining readily with certain other metals finds extensive application in the metallurgical treatment of gold and silver ores, "silvering" of mirrors, covering zinc plates in a battery, etc. (2) A natural alloy of silver and mercury found at Moschellandsberg, Bavaria. AgHg and Ag_2Hg_3.

Amalgamation. Process for preventing local action, first applied to voltaic batteries by Kemp. It consists in covering the zinc plate with a layer of mercury. By this means a layer of pure zinc is brought on the surface, and this is not attacked by the acid solution unless the battery is in action. Thus local currents due to the impurities in the zinc are obviated.

Amalric, or Amanry, 1135–1173. Latin King of Jerusalem 1162, involved in contests with the Templars.

Amalric of Bena, d. 1209. Schoolman, condemned by the Pope and the Univ. of Paris in 1207; his bones were exhumed and burned with his writings in 1210. His followers endured much persecution for their pantheistic tenets, which were revived by the Brethren of the Free Spirit (q. v.). Their worst heresy placed believers beyond the reach (or the imputation) of sin.

Amalthea. Nurse of the infant Jupiter, or, as others say, the goat which suckled him. One of her horns being broken off, the god filled it with whatever the possessor might desire; hence the Cornucopia.

Amapatolli. "Paper game." Old Mexican name for playing cards, introduced into America by the Spaniards at the time of the Conquest. Two sheets of cards made in Mexico 1583 are preserved in the Archives of the Indies at Seville.

Love-lies-bleeding (*Amaranthus caudatus*).

Amaranth. Plants of genus *Amaranthus*, bearing large clusters of minute flowers subtended by green or purple bracts. They are mostly natives of tropical America, but widely distributed as weeds. The Globe A., *Gomphrena globosa*, is an herb sometimes planted for ornament.

Amaranthaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 50 genera and about 450 species, distributed throughout the world except the colder regions; commonly called the Amaranth Family.

Amara-Sinha, ab. 56 B.C. Sanscrit grammarian and poet. Being a Buddhist the Brahmans attempted to destroy his works. We have, however, the *Amara-Kosha*, a vocabulary of ab. 10,000 Sanscrit words, arranged according to the roots in three books, whence called the *Trikandra*.

Amaravati. Site in Southern India on the river Kistnah, famous for a Buddhist tope from which many important relief sculptures were excavated in 1845 and brought to England. These are now an ornament of the main stairway of the British Museum. Their date is probably 3d century B. C. See Fergusson's *Tree and Serpent Worship*.

Amari, Michele, 1806–1889. Italian historian, associate of Garibaldi and Cavour. *War of the Sicilian Vespers*, 1842; *Sicily and the Bourbons*, 1849; *Mussulmans in Sicily*, 1854–68.

Amaryllidaceæ. Natural family of flowering plants of the class *Angiospermæ*, sub-class *Monocotyledones*, comprising 65 genera and ab. 600 species, widely distributed through the temperate and warmer regions of the earth; commonly called the Amaryllis Family.

Amaryllis. Pastoral belle in Theocritus and Virgil.

Amasa. Son of Abigail, half sister of David; made general-in-chief by the rebellious Absalom, after whose death David made him commander-in-chief in place of his cousin Joab, who thereupon treacherously assassinated him.

Amasta. Monotremes, which are mammals without teats.

Amat, Felix de Torres, 1772–1840. Bp. of Astorga, and official translator of the Bible into Spanish, 1823; author of a *Dictionary of Catalan Writers*, 1836.

Amaterasu. The Sun Goddess of Japanese Shinto mythology, and the reputed ancestress of the first Mikado and founder of the present imperial dynasty of Japan.

Amati. Family of Cremona, famous in the annals of violin making. Their best instruments were produced between 1590 and 1620.

Amaurosis. Impairment or loss of vision, due to injury or disease of the deeper portions of the eye, optic nerve, or brain.

Amaziah. Eighth king of Judah, ab. 837–809 B.C. He defeated Edom, became an idolater, was overthrown by Jehoash of Israel ab. 824, and killed at Lachish.

Amazon. Largest river of South America, and in volume of water, drainage area, length and navigability of tributaries, largest in the world. It heads in the Andes, draining their east front from lat. 20° s. to 3° n. The descent from the mountains is very abrupt, and at their base the country is but a few hundred feet above sea level. The river enters the Atlantic through an immense delta. Its principal branches are the Negro, Japura, Ucayali, Purus, Madeira, Tapajos and Tocantins. Its length is between 3500 and 4000 miles, and its drainage area nearly 3,000,000 sq. m. Upon the main stream and its tributaries there are fully 10,000 m. of navigable water. Its average discharge at its mouth is 2,458,000 cubic ft. per second. The effect of tides is felt 400 m. above its mouth.

Amazons. Mythical race of female warriors, said to have settled about the river Thermadon in Asia Minor. Toward the end of the Trojan war they came to assist Priam.

Amazon-stone. $K_2Al_2Si_6O_{16}$. Bright green variety of potassium feldspar, microcline, closely resembling orthoclase. Color is due to organic compound of iron. Named from the Amazon R. Handsome specimens have been found in the granite of Pike's Peak, Col.

Ambarvalia, or Ambarvale Sacrum. Ancient Roman festival, in May, lasting three days. Besides private rites, the Arval Brothers conducted a sacrifice in the name of the state, the "Suovetaurilia," so named because a sow, a sheep, and a bull were led around the fields and then offered with prayers to Ceres, goddess of crops.

Ambassador. Minister accredited by one sovereign to the court of another. The representatives of the U. S. in foreign lands received this title 1893 in some cases.

Amber. Fossil resin of tertiary age, found in small, translucent, or sometimes transparent, masses of irregular shape in the soil, or in slightly consolidated recent geological formations, near the surface, in various parts of the earth. It is yellowish, brownish, or reddish in color, and frequently incloses remains of insects which became imbedded in it as it oozed from the trees. Its association with fragments of wood or lignite proves its vegetable origin. The regions about the Baltic Sea supply the greater part of the amber of commerce. It is not found in the U. S. in paying quantities. The world's yield of amber at present is about 150 tons a year. On treatment with nitric acid it furnishes succinic acid.

Amberger, Cristoph, 1490–1561. German portrait painter, mainly active in Augsburg; after Holbein, one of the best artists of his time. His pictures are in Augsburg, Stuttgart, Gotha, Berlin, Vienna, and Florence.

Ambergris. Grayish fatty substance, found in the bowels

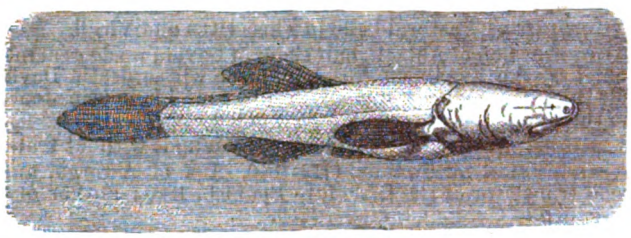
of the spermaceti whale, and upon certain seashores. Contains Ambrein and is very valuable. It is used in the manufacture of perfumes.

Ambiens Muscle. In the homalogonatous birds. Originating from the prepubic process of the pelvis, it passes on the inside of the thigh, over the patella or knee as a thin tendon, and is inserted into the outer side of the leg, joining the superficial flexor of the toes.

Amblygonite. $2Al_2P_2O_8+3Li(Na)F$. Aluminium and lithium phosphate, containing also several per cent of fluorine; good crystals have been found in Maine.

Amblyopia. Diminution of the vision, due to the same causes as amaurosis.

Amblyopsis. Genus of fishes of which the blind fish of



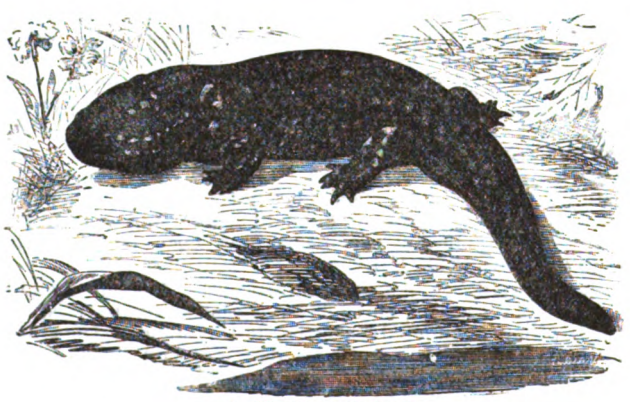
Amblyopsis spelæus.

the Mammoth Cave, Ky., is the best example. The eyes are rudimentary only, and covered by the skin. See HAPLOMI.

Amblypoda. Order of Sub-Ungulates, including the two sub-orders *Dinocerata* and *Pautodonta*, placental mammals of the Eocene period. The *Dinocerata* include gigantic forms with five-toed feet, elephantine limbs, no upper incisors, but the upper canines developed into downwardly-directed tusks. The nasals, maxillaries, and frontal bones bear each a pair of horn-cores, so that possibly the animal possessed three pairs of horns. There was no proboscis, and the brain was the smallest proportionally possessed by any mammal. The characters of *Pautodonta* are given under CORYPHODONTIDÆ.

Amblypterus. Lepidoganoid fish resembling Palæoniscus, but with shorter and deeper tail and larger body-fins devoid of anterior spines; found in the Coal Measures.

Amblystoma. Genus of SALAMANDRINA (q. v.), widely distributed in N. America, and remarkable for the fact that its larval development can be delayed indefinitely by subjecting



Amblystoma tigrinum.

the menobranchus-like young to a continuance of its aquatic environment. See AXOLOTL.

Amboise. Town of Central France, where a Huguenot conspiracy was suppressed Jan. 1560, and an edict granting toleration to the Huguenots issued March 19, 1563.

Amboyna. One of the Moluccas or Spice islands, held by the Portuguese with intervals since 1580. Area, 264 sq. m. Pop., ab. 30,000.

Ambros, AUGUST WILHELM, 1816–1876. Composer, and ablest of modern musical historians. Prof. Univ. Prague 1869. *Poetry and Music*, 1856; *History of Music*, 4 v., 1862–78.

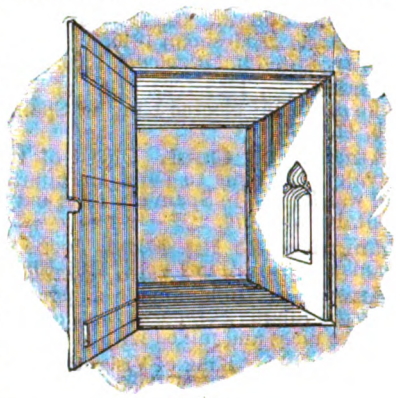
Ambrose, ST., ab. 340–397. Bp. of Milan 374, and one of the four great Latin fathers; eminent for devoutness, benevolence, firmness, eloquence, power of government, and all the virtues. He baptized St. Augustine, excommunicated Theodosius, reformed church music, and wrote hymns that are still used.

Ambrosia. Food of the Olympian gods.

Ambrosian Chant. Musical service established by St. Ambrose ab. 384 for the cathedral in Milan. Its characteristics are unknown.

Ambrosian Hymn. *Te Deum Laudamus.* A legend, which has no foundation in fact, attributes its composition to Saints Ambrose and Augustine. It is of later date and uncertain authorship.

Ambry. Small cupboard, formerly used in monasteries for keeping vessels pertaining to ritual.



Ambry.

Ambulacral Groove. In Echinoderms, especially Crinoids and Star-fishes, that in which the series of *ambulacra* (sucker-feet) lie. It runs on the oval side of each arm.

Ambulacral Ossicles. Plates through or between which the ambulacra of Echinoderms project. Also, the sub-ambulacral ossicles in star-fishes, which are exposed and the only ossicles corresponding in position to the true ambulacral ossicles. See AURICULA.

Ambulacral Plates. True ambulacral ossicles of sea urchins.

Ambulacral Pores. Zigzag line of openings between ambulacral ossicles through which the ambulacral feet project.

Ambulacral Rosette. Petaloid figure formed by the ambulacral zones when they radiate from the aboral pole only, as in certain Echinoids.

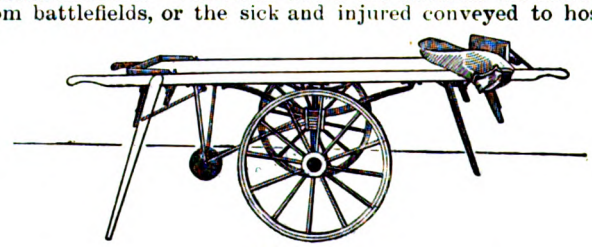
Ambulacral Shields (OF OPHINROIDS). Plates that cover the ambulacral grooves ventrally; also known as super-ambulacral shields.

Ambulacral Surface. See ACTINAL SURFACE.

Ambulacral Suture. Line of junction of the two rows of ossicles which constitute each ambulacral ray.

Ambulacral System (OF ECHINODERMS). The oval or actinal surface of star-fishes, sea urchins, etc., traversed by five double rows of locomotor suckers radiating from the mouth. The suckers pass out between a double series of calcareous plates, which are set vertically and transversely to the axis of the ray, and in star-fishes are sometimes called vertebral ossicles. In the star-fish each row of suckers is really a zigzag, which gives each ray the appearance of having four rows of these ambulacral feet. Each sucker has at its inner end a sac (ampulla), and is connected with a water-tube which lies in a groove in the vertebral ossicles, and radiates from a circular tube about the mouth, on which are ten polian vesicles and nine racemose vesicles and a stone-canal, ending on the aboral surface by the madreporite, sieve-plate, which admits water to the whole system.

Ambulance. Vehicle in which the wounded are removed from battlefields, or the sick and injured conveyed to hospi-



Ambulance.

tals. The service attending the former was developed in the Crimean war.

Ambulatorii. Birds having walking legs with three toes forward, the middle and outer being united at their roots, and the inner directed backward.

Ambulatory. In architecture, part or appendage of a building arranged for the passage of processions; often the passage around the choir of a Gothic church, which is a continuation of the outer aisle of the nave.

Ambuscade, or AMBUSH. Cover concealing a body of troops, intended to surprise an approaching enemy and by a sudden and unexpected attack to overwhelm him.

Amen. Hebrew word meaning truth, certainty. In Rev. iii. 14, a name of Christ. In St. John, beginning sentences, it is translated "verily." From Apostolic times it has been used as a response at the end of a prayer.

Amendment. Correction of an error in legal process; change in a motion or bill; alteration of a constitution (q. v.).

Ament. See CATKIN.

Amentaceæ. Orders of plants which bear their flowers in aments or catkins, as in *Betulaceæ*, *Salicaceæ* and *Myricaceæ*.

Amenthes. Mythological Hades of Egyptians.

America. Name derived from Amerigo Vespucci, an Italian who in 1499 visited the western continent. The Northmen are believed to have coasted from Labrador to Rhode Island ab. 1003. Columbus reached the West Indies 1492, and on his third voyage discovered S. America near the mouth of the Orinoco 1498, and Honduras on his fourth voyage 1502. John Cabot probably touched N. America 1497. Balboa crossed the Isthmus of Darien 1513. The coast of Brazil was explored by Pinzon and Diego de Lepe 1500, and soon after reached by the Portuguese Pedro Alvarez de Cabral, who was on his way to India around Good Hope. Magellan sailed to the west side of S. America 1520.

Cortez conquered Mexico 1519–21; Pizarro conquered Peru 1532–3. First settlement in Nova Scotia (Acadie) 1604; at Quebec 1608; at Jamestown, Va., 1607; in Newfoundland and on the Hudson 1611; at Plymouth, Mass., 1620. The oldest settlements in the U. S. are St. Augustine 1565, and Santa Fe 1582. See NORTH, CENTRAL, and SOUTH AMERICA. (See Map on next page.)

America, BRITISH. Dominion of Canada, Newfoundland, Br. Honduras, Br. W. Indies, Bermudas, and Falkland Is.

America, CENTRAL. See CENTRAL AMERICA.

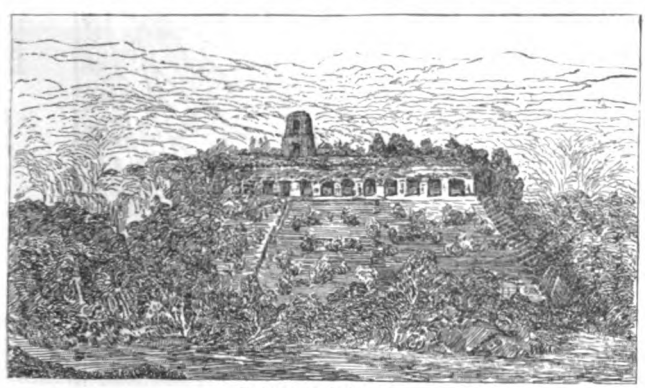
America, RUSSIAN. Term formerly applied to Alaska, bought by U. S. 1867.

America, SOUTH. See SOUTH AMERICA.

America, SPANISH. Formerly most of the continent s. of the U. S.; now merely Cuba and Porto Rico.

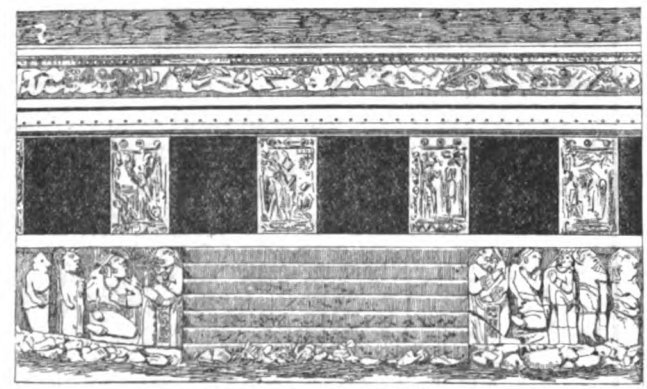
American Academy of Arts and Sciences. At Boston; founded 1780. An association of scientists, holding meetings for the reading of papers and discussion. It publishes Proceedings and Memoirs.

American Architecture. Evidences have been discovered, in both N. and S. America, that some part of each continent had been occupied, at some time before the discovery of the country by Europeans, by races more highly civilized than those which possessed it at the time of the discovery. These evidences consist in remains of buildings in Peru, Mexico, and Central America, especially in Yucatan. The Peruvian remains, which are supposed to be the work of a race anterior to the Incas, whom the Spaniards found in possession, are extensive and



Palace at Palenque.

massive, but of a rude and primitive character. They consist of circles of stones, like those in Europe, of which Stonehenge is the most familiar example, of walls of vast stones, accurately fitted, and evidently intended as fortifications, and of square and round towers of masonry, increasing in size from the bottom to the top, and in some cases covered with domical roofs of overlapping stones. The remains in Yucatan and Mexico are more interesting as showing a much greater skill, and also in consequence of their striking resemblance to the ancient architecture of Central Asia, especially in the erection of temples upon the summit of a series of receding terraces. The most extensive building of the ruins which remain in Yucatan, that at Palenque, is thus arranged. By some it is supposed to have been a palace, and by some a temple. The extent of the pyramidal substructure at the base is 310 ft. by 260, and it is 40 ft. high. The superstructure is 25 ft. high, of a single story, and the rooms and corridors are arranged about three courts of unequal size. The ceilings are formed by slabs of stone carefully joined



Interior Facade, Palenque.

and fitted. The whole is of masonry, but there are remains of a smooth stucco with which it was once covered, within and without, and which was used as a ground for pictorial decoration.

American Association for the Advancement of Science. Founded 1847. It meets annually for the reading of papers and discussion, and publishes Proceedings.

American Literature. During the colonial period it was nearly confined to theology, and was produced chiefly in New England. The Revolution called forth much political writing, preëminently that of Thomas Paine, and minor poets like Barlow and Freneau. The first fiction of any note came from C. B. Brown. The first poem of real value was Bryant's *Thanatopsis*—but here we are within the 19th century.

The main beginners of a national literature were Irving, whose great successes were largely won abroad, and Cooper, whose *Leatherstocking Tales*, though built in spirit and style on Scott's foundation, were in subject matter purely native. W. G. Simms and others followed in his wake. Our greatest geniuses were Hawthorne, master of subtle and introspective romance, and Poe, doomed to misfortune by his deficiencies of character, but reckoned abroad our foremost literary figure. In history Bancroft, Prescott, Widley and Parkman lead a roll of worthy names. Poetry, beginning with Bryant, was long most successfully cultivated in eastern Mass., where Longfellow won the love of nations, and Whittier stirred or soothed men's hearts. Emerson, most inspiring of essayists, was at his best in his rare best verse. These were joined somewhat later by Dr. Holmes, most witty and versatile of writers, and Lowell, whose scholarship and critical aptitude too often obscured from public view his deep and splendid originative powers: his *Harvard Commemoration Ode* and Emerson's *Problem* show the high-water mark of American verse poetry. The fame of Thoreau, a prose poet, is mainly posthumous.

Of late, fiction has taken the place of poetry. Howells, with all his realistic theories, is at the head of our novelists; after him come Marion Crawford and Henry James, who live mostly in Europe; Mrs. Burnett, Miss Woolson, Miss Wilkins, Stockton, and Cable. Bret Harte is best in California themes, and Page is almost the laureate of Virginia. R. H. Davis is a master of the short story. Stevenson and Kipling, though now or lately residents of the U. S., are properly claimed by Britain. Mark Twain is the foremost living humorist.

In science America has Agassiz and other names that bring her abreast of Europe. In religion, Bushnell, in the past, and Dr. Briggs, to-day, represent the reforming and innovating spirit, while Beecher and Brooks made the pulpit illustrious.

American literature, though a plant of recent growth, now holds its own in every field, as is shown by the names of many hundreds of authors throughout this work.

American Party. See KNOW NOTHING.

American Philosophical Society. In Philadelphia, founded 1744. An association of scientists holding meetings for the reading of papers and discussion. It publishes Proceedings and Transactions.

American Race. Characterized by brown-yellow, or copper-red skin, stiff black hair, deep-set eyes, projecting cheek-bones and broad face. The forehead is narrow, the nose short but projecting. See INDIANS.

American University. At Washington, D. C., chartered May 28, 1891; is designed for post-graduate instruction, and controlled by the M. E. Ch.

FIRST MAP CONTAINING THE WORD "AMERICA."

Americanisms. Peculiarities in word or phrase which belong to the U. S. and are foreign to British usage. See J. R. Bartlett's *Dictionary of Americanisms.*

Americus Vespucius. See VESPUCIUS.

Amerighi. See CARAVAGGIO.

Ames, FISHER, LL.D., 1758–1808. Prominent Federalist, M. C. from Mass. 1789–97. His political essays were signed "Camillus" and "Brutus."

Ames, WILLIAM, D.D., 1576–1633. English Puritan, in Holland from 1611. *Medulla Theologiæ*, 1623, tr. as *Marrow of Sacred Divinity*, 1642.

Ametabola. Insects that do not undergo metamorphosis, usually wingless; comprising the orders *Anoplura*, *Mallophaga*, *Collembola* and *Thysanura* (lice, bird-lice, spring-tails, etc.).

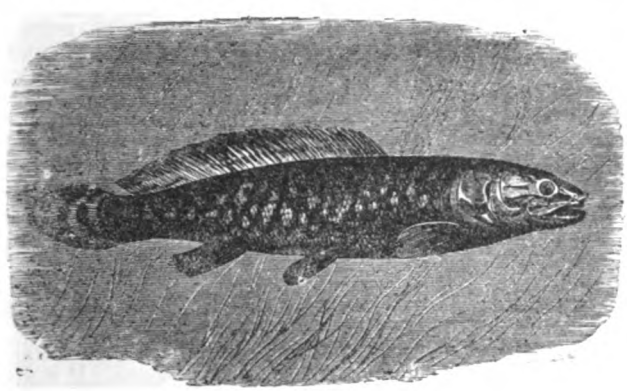
Amethyst. SiO_2. (1) Purple or violet quartz, the color, which is liable to fade on long exposure to the light, being probably due to manganese or iron. It is frequently found lining walls of geodes. The n. shore of Lake Superior has furnished many large masses, but the gems of purest color come from Brazil or Siberia. (2) The oriental amethyst, a purple variety of corundum, is much harder and brings a much higher price.

Ametropia. Abnormal or impaired vision.

Amherst, JEFFERY, LORD, 1717-1797. British officer. He took Louisburg 1758 and Montreal 1760; was Gov. of Va. 1763; made Baron A. 1776; commander-in-chief in America 1758, and in England 1778–82 and 1793–95; field-marshal 1796.—His nephew, WILLIAM PITT, 1773–1857, was envoy to China 1816, and Gov.-gen. of India 1823-26; first earl of A. 1826.

Amherst College. At Amherst, Mass.; founded 1821; chartered 1825. It has 25 professors, 6 instructors, and ab. 400 students, an annual income of ab. $75,000; a library of 61,000 volumes, and valuable collections. The Mass. Agricultural College, also at Amherst, opened 1867, has a faculty of 14 and 160 students; permanent funds ab. $500,000.

Amiades (HALECOMORPHA). Tribe of Ganoid fishes with bony skeleton, round enameled scales, bony branchiostegal rays and heterocercal tail-fin. There are no fulcra. This group includes *Amia calva*, the Mud-fish or "Dog-fish" of American



Amia calva.

rivers and lakes. It is allied to the Teleosts. It has a long undifferentiated dorsal fin. The swim bladder can to a slight extent function as a lung, and the fish will live out of water for several hours.

Amiantus, or AMIANTHUS. Finer and more silky fibrous varieties of amphibole and pyroxene (asbestus), and of serpentine (chrysotile).

Amicis, EDMONDO D', b. 1846. Italian descriptive writer. *Spain*, 1873; *London*, 1874; *Morocco*, 1876; *Paris*, 1878; *Constantinople*, 1878.

Amida (or AMITABHA) **Buddha.** Originally regarded as impersonal, as the ideal of boundless light. The dogma of Amida is supposed to have been originated by Persian or Gnostic ideas influencing the Buddhism of Cashmere and Nepaul, for it must have been from one of these countries that it reached China (*via* Thibet). According to the doctrines of the Mahâtzâna school, Amida is regarded as the celestial reflex of Sakyamuni. "The doctrine of Amida and his paradise in the western heavens is, strictly speaking, no contradiction to the doctrine of Nirvana, for it does not interrupt the circle of transmigration, though it offers to the devotee of Amida æons of rest. But the popular mind understands his paradise to lie beyond the circle of Metempsychosis, and the common people look upon this Pure Land of the West exactly in the same light as the Christian looks upon his promised rest in Heaven."

Amides. Organic ammonias in which the hydrogen of ammonia is conceived to be replaced by an acid or oxygenated radical or radicals; thus from ammonia (NH_3), acetamide, $CH_3.CO.NH_2$, by replacing hydrogen by the acetyl group.—In botany, crystallizable organic substances containing nitrogen, mostly found in the more immature parts of plants. They are held by authorities to be less valuable for feeding purposes than the protein substances, though from the difficulty of separating the two they are usually classed together.

Amidines. Compounds derived from the amides by substitution of the group NH: for the oxygen of the amides. Thus from acetamide, $CH_3.CO.NH_2$, is derived acetamidine, $CH_3.CNH.NH_2$.

Amidoacetic Acid. See GLYCOCOLL.

Amidoazobenzene. $C_6H_5.N:N.C_6H_4.NH_2$. Amidoazo compound prepared by the action of nitrous anhydride upon aniline. See ANILINE YELLOW.

Amidoazo Colors. Artificial coloring matters containing the amidoazo group, $NH_2.N:N$.

Amidoazo Compounds. Containing an azo grouping .N:N., and also an amido group, $.NH_2$.

Amidoazonaphthalene. $C_{10}H_7.N:N.C_{10}H_6NH_2$. Brownish-red needle-like crystals, formed by the action of nitrous anhydride upon naphthylamine.

Amidobenzene. $C_6H_5.NH_2$. See ANILINE.

Amidobenzoic Acids. $NH_2.C_6H_4.COOH$. Orthoamidobenzoic or anthranilic, metamidobenzoic, and paramidobenzoic. They are weak bases as well as acids. They are best prepared by the oxidation of the corresponding toluides.

Amidocompounds. Belonging to the aromatic or benzene series and containing the group $.NH_2$ united directly to carbon, as $C_6H_5.NH_2$ aniline.

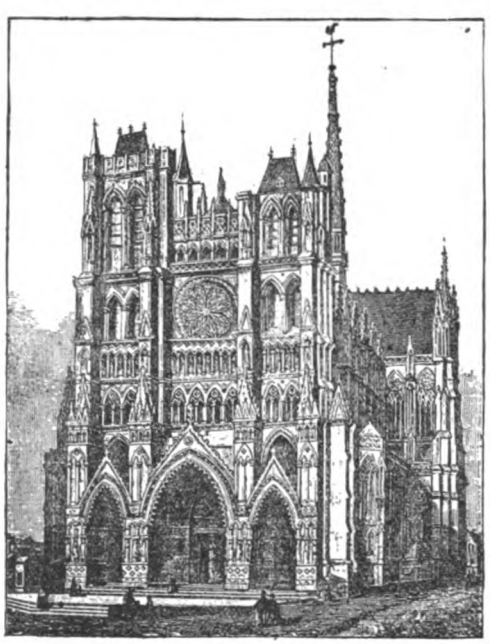
Amidogen. NH_2 or amido group of atoms. See HYDRAZINES.

Amidophenols. $HO.C_6H_4.NH_2$. Phenol in which one atom of hydrogen is conceived to be replaced by the $.NH_2$ or amido group, known in three isomeric forms, the ortho-, meta- and para-amido phenol.

Amido Plast. See LEUCOPLASTID.

Amiel, HENRI FREDERIC, 1821–1881. Swiss poet, prof. at Geneva from 1849. His fame rests on his *Journal Intime*, 1882–84, tr. 1889.

Amiens. City of France, on the Somme, 40 miles from its mouth. It has a fine cathedral, built 1220, and a library of



Amiens Cathedral.

60,000 vols. Peter the Hermit was born here 1050. Pop., 1891 83,654.

Amiens, TREATY OF. Between Great Britain, France, Spain and Holland; signed March 27, 1802. England gave up nearly all her conquests and evacuated all ports in Mediterranean; Egypt was restored to Turkey, but England declared war again the next year. The Germans under Gen. Manteuffel gained a victory over the French army of the North at A. Nov. 27, 1870.

Amimia. Pathological state in which the power of expressing ideas by means of gesture is lost or impaired; usually associated with APHASIA (q.v.).

Amines. Organic bases conceived to be formed by the replacing of hydrogen in ammonia (NH_3) by groups consisting of carbon and hydrogen atoms in combination. Either one, two, or three hydrogen atoms may be replaced. See METHYLAMINE.

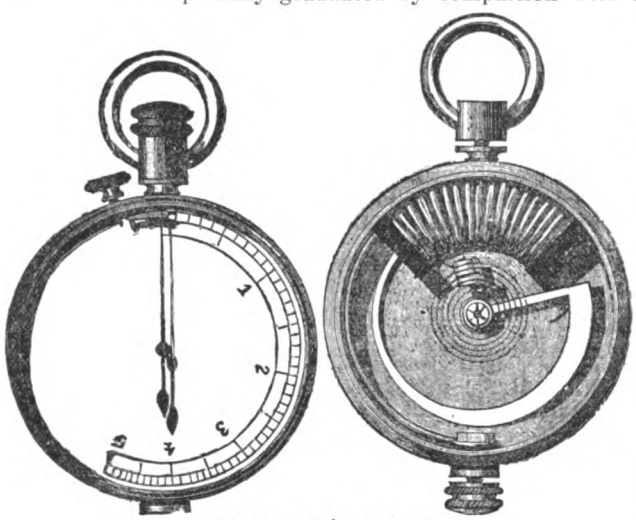
Ammanati, BARTOLOMMEO, 1511–1592. Florentine architect and sculptor of the Renaissance decadence. His best known work is the fountain in the Piazza del Gran Duca, Florence.

Ammann, PAUL. 1634–1691. Prof. in Leipsic, *Character plantarum naturalis*, 1676.

Ammen, DANIEL, U.S.N., b. 1820. He served with distinction in the civil war, was retired as rear-admiral 1877, designed the ram Katahdin, built 1889, and pub. *The Old Navy and the New*, 1891. See SHIPS AND RAMS.

Ammergau Mystery. See OBERAMMERGAU AND PASSION PLAYS.

Ammeter (AMPERE-METER). Direct reading instrument for indicating in amperes the strength of an electric current. The indications are given by an index which moves over a dial. The instrument is empirically graduated by comparison with a



Pocket Ampère-meter.

standard galvanometer. In the one represented, the pivoted, crescent-shaped core, attached to the pointer, is drawn into a curved coil, the counteraction being a hairspring.

Ammianus Marcellinus, d. ab. 390. Roman historian of Greek birth. His first 13 books, from A. D. 96, are lost; the remaining part covers the years 353–378, and is valued as accurate and impartial, but not for its Latinity.

Ammocœtes. See LAMPREYS.

Ammon, AMEN, or AMUN. Egyptian god, identified by Greeks with Zeus (Jupiter); local deity of Thebes, worshiped also on the oasis of Siwah, or Ammonium, in the Libyan desert; sometimes represented as a ram.

Ammon. Semitic tribe east of the Jordan, descended from Ben-Ammi, son of Lot; often at war with Israel, and defeated by Jephthah, by several of the kings, and by Judas Maccabæus.

Ammon, CHRISTOPH FRIEDRICH VON, 1766–1850. German rationalist, prof. at Göttingen and Erlangen, court preacher at Dresden 1813–49, and a prolific writer.

Ammonia. NH_3. Sp. gr. 0.59, liquefies at —40° C. or 10 Atm. pressure. Sp. gr. liq. 0.62. Bpt. —33.7° C., 749 mm. Solid —75° C. at 20 Atm. pressure. Sp. H. 0.508. Colorless, suffocating gas, disc. by Priestley 1774, made by decomposing ammonium sulphate in water with lime. Does not support animal life or combustion, but burns in oxygen. One volume of water will dissolve 670 volumes of the gas, and has sp. gr. 0.875. This solution of the gas in water is what is sold under the name of ammonia, or spirits of hartshorn. The gas can be compressed to liquid by 125 to 150 lbs. pressure and comes into the market in metallic cylinders, for the manufacture of ice. Its solution is used for cleaning purposes, and in medicine to relieve the pain of the stings of poisonous insects, to irritate the skin, either undiluted or combined with oily matters, to restore consciousness in fainting, and as a stimulant of the heart; for this latter purpose its carbonate is preferable.

Ammonia Alum. $(NH_4)Al(SO_4)_2.12H_2O$. Made by bringing ammonium and aluminium sulphates together in molecular proportions. It closely resembles ordinary alum in its properties, and can be manufactured more cheaply; hence it is now used extensively as a substitute for alum, especially in dyeing.

Ammoniacal Liquor. Obtained in the manufacture of illuminating gas from coal, the gas being washed with water to remove it. The ammonia compounds are dissolved and are the chief source of commercial ammonia salts; 22 lbs. ammonium sulphate per ton of coal is sometimes obtained. It is mixed with lime and heated with free steam, and the ammonia, set free, conducted into sulphuric acid, forming ammonium sulphate, which crystallizes out.

Ammoniacum. Gum-resin produced by *Dorema ammoniacum*, a plant of the Carrot family, native of w. Asia.

Ammonia Process for Soda. See SODIUM CARBONATE.

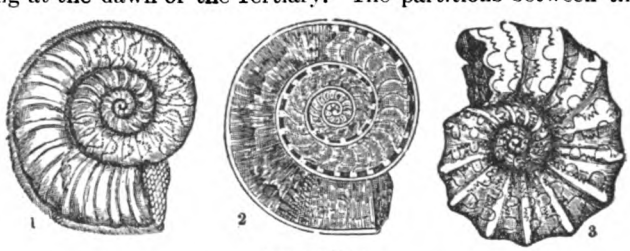
Ammonias, ORGANIC. Amines; also, amido compounds and amides.

Ammonio-cobalt Salts. Cobaltous salts, treated with ammonia, in a closed vessel, unite with the ammonia, forming these compounds. Most of them contain 6 molecules of NH_3 to 1 of the cobalt salt: thus, $COCl_3.6NH_3.H_2O$.

Ammonio-copper Compounds. See CUPRAMMONIUM COMPOUNDS.

Ammonio-platinum Salts. When ammonia acts upon a solution of platinous chloride, a compound of the formula $PtCl_2(NH_3)_2$ is formed. If it be platinic chloride, the resulting compound is $PtCl_4(NH_3)_2$. There are many similar compounds.

Ammonite. Ornate and highly developed spirally coiled cephalapod shell, related to the pearly Nautilus; appearing in numerous species in the early Mesozoic period, and disappearing at the dawn of the Tertiary. The partitions between the



Ammonites:
1, *Ammonites obtusus*; 2, section of *Ammonites obtusus*, showing the interior chambers and siphuncle; 3, *Ammonites nodosus*.

chambers are plaited where they meet the shell, so as to form at the junction exceedingly intricate and beautiful patterns, which are characteristic of the genus.

Ammonites. See AMMON.

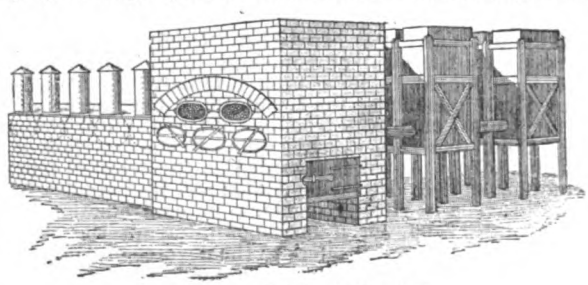
Ammonium. Hypothetical compound, the composition of which is assumed to be NH_4. In the ammonium salts, examples of which are NH_4Cl, $(NH_4)_2SO_4$, the group of atoms, NH_4, acts as a metal; for this reason it is given a name ending in *um*, as is customary in the designation of metals.

Ammonium Acid Carbonate. See AMMONIUM BICARBONATE.

Ammonium Amalgam. Substance having a metallic luster, resembling in general the other amalgams. It is very unstable, but has been obtained in crystalline form at a low temperature. It is made by pouring a solution of ammonium chloride upon sodium amalgam. The product is voluminous and swells up during the reaction. It is about twenty times the volume of the sodium amalgam.

Ammonium Bicarbonate. Primary ammonium carbonate, NH_4HCO_3. Made by treating ammonium carbonate with carbon dioxide. It is used in the manufacture of baking powders.

Ammonium Carbonate. $(NH_4)_2CO_3$. Made commercially by heating together ammonium chloride, or sulphate and



Ammonium Carbonate Purifiers.

chalk. Prepared in this way it is not pure; it contains ammonium bicarbonate and carbonate. The pure substance de-

composes at 58° C., yielding carbon dioxide, water, and ammonia. It is used in the manufacture of baking powders.

Ammonium Chloride, or SAL AMMONIAC. NH_4Cl. Formerly obtained from Egypt, being extracted by sublimation from salt and camel's dung. At present its principal source is from the ammoniacal liquor of the gas-works. It has a sharp, salty taste, is soluble in water and sublimes on being heated. It is used in medicine.

Ammonium Compounds. Organic compounds in which one or more of the hydrogen atoms of the group, ammonium (NH_4.), is conceived to be replaced by an organic group, as in $NCH_3H_3.I$, methylammonium iodide.

Ammonium Hydroxide (SPIRITS OF HARTSHORN). NH_4OH. If ammonia be passed into water a solution is obtained having the odor and characteristics of the gas; it is strongly alkaline and has the properties of a base. On account of its close resemblance to solutions of metallic hydroxides, it is believed to contain the compound, NH_4OH. It is sold under the name of AMMONIA (q.v.).

Ammonium Magnesium Phosphate. See MAGNESIUM AMMONIUM PHOSPHATE.

Ammonium Nitrate. NH_4NO_3. Made by neutralizing nitric acid with ammonium hydroxide. It is very soluble in water and can be readily obtained in crystals. It is used for the preparation of nitrous oxide, and as a constituent of certain explosives, as Ammonite, Bellite and Roberite. A small quantity occurs in the atmosphere.

Ammonium Nitrite. NH_4NO_2. On being heated it is decomposed into water and free nitrogen; it, therefore, furnishes a method for the preparation of nitrogen.

Ammonium Phospho-molydate. $(NH_4)_3.PO_4.12MoO_3$. Yellow substance, insoluble in water and in dilute acids. It is formed by adding a nitric acid solution of ammonium molybdate to a solution of phosphoric acid or a phosphate. This furnishes a valuable means for detecting phosphoric acid, and hence is used extensively in analytical operations.

Ammonium-sodium Phosphate. See SODIUM-AMMONIUM PHOSPHATE.

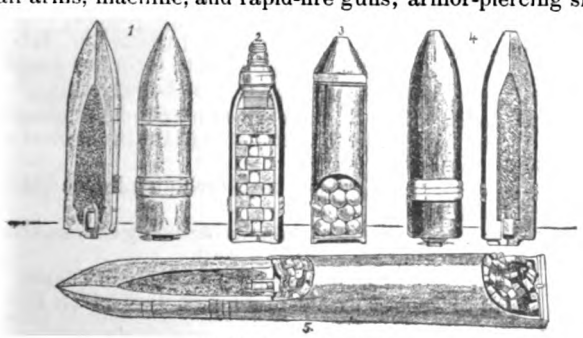
Ammonium Sulphate. $(NH_4)_2SO_4$. Prepared on a large scale for use as a fertilizer. It is soluble in 2 parts of water and crystallizes in long, flattened, six-sided prisms. See AMMONIACAL LIQUOR.

Ammonium Sulphide. $(NH_4)_2S$. Made by passing sulphuretted hydrogen into ammonium hydroxide until it is saturated, then a similar volume of ammonium hydroxide is added. It is used in chemical analysis to precipitate the metals of the ammonium sulphide group. When first made, it is a colorless liquid of a disagreeable odor. Upon standing it becomes yellow, due to the formation of the polysulphides $(NH_4)_2S_2$, $(NH_4)_2S_3$, $(NH_4)_2S_4$, and $(NH_4)_2S_5$.

Ammonium Sulphocyanate, or THIOCYANATE. $NH_4.S \vdots C.N$. Ammonium salt of sulphocyanic acid, prepared by the action of ammonia and alcohol upon bisulphide of carbon. White plates easily soluble in water. See SULPHOCYANIC ACID.

Ammonius Saccas, d. ab. 241. Alexandrian philosopher, founder of the Neo-platonic school.

Ammunition. Fuel for guns and small-arms, is classified as metallic and non-metallic and fixed, rim and center fire for small-arms, machine, and rapid-fire guns; armor-piercing shot,



Ammunition in Section.
1, Steel-shell; 2, Shrapnel; 3, Case-shot; 4, Common shell; 5, Complete cartridge.

canister, case-shot, grape-shot, multicharge, Palliser-chilled shot, shells (common and armor-piercing) and shrapnel. It formerly indicated military stores and provisions.

Ammunition Box. Specially constructed and protected for the safe and convenient transportation of ammunition.

Ammunition Tubes. In modern war-ships thick hollow steel forgings to protect ammunition in transit to battery.

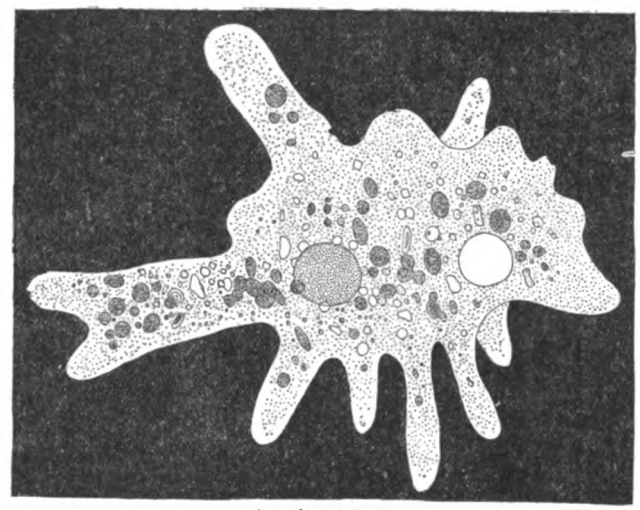
Amnesia. Loss of memory; more specifically, a pathological condition in which memory-pictures of words are lost or deranged; a form of APHASIA (q.v.).

Amnesty. Act of oblivion, granted generally to a community or class of political offenders.

Amnion. Formed as the body wall of embryo of higher vertebrates grows up and envelops the back of the embryo by the union of the folds as they meet. The true or inner amnion forms a bag, filled with amniotic liquid in which the embryo floats. It is popularly known as the "bag of waters." The outer amnion is at first a perfectly spherical shell surrounding the true amnion and the yolk sac. From the latter it ultimately splits entirely away and becomes attached to the egg-shell or chorion. That of insects is formed in the same way as in vertebrates, and similarly overlies the neural plate, which becomes the ventral part of the insect and the dorsal part of the vertebrate.

Amniota. Birds, reptiles, and mammals collectively, as developing an amnion during embryonic life.

Amœba. Proteus animalcule, so called because its form of body is always changing, owing to the fact that pseudopodia are formed and retracted at will from any part of the surface. It is a naked rhizopod and represents a single cell, having a clear, firm ectosarc and a fluid, granular endosarc, with a nucleus imbedded in the former. It multiplies by simple division, which is preceded by division of the nucleus, so that each daughter amœba is nucleated from the start. This



Amœba proteus.

animal eats by simply allowing its food (which is vegetable, sometimes algæ, sometimes bacteria, etc.) to sink into the substance of its body or by inclosing it with its protoplasmic pseudopods. Then the albuminous parts are digested out, and assimilated by being converted into a part of the protoplasm of the amœba, while the indigestible cellusose wall and starchy contents are ejected from whatever part of the body happens to be hindmost. When moving, it causes a part of its substance to flow out in any direction (forming a pseudopod), and the rest of the body flows into this pseudopod, swelling it up and converting it into the body of the amœba. There seem to be no organs, no nerves, no stomach, etc., present; yet the animal can perceive the presence of food, can travel, digest, reproduce, successfully maintain itself, and do all that protoplasm in any animal can do. It can be killed or destroyed, but never dies of old age. It simply grows, and then multiplies by splitting into two halves, which are young amœbæ.

Amœbea. See AMŒBINA and ARCELLINA.

Amœbiformes. Rhizopods like the amœba. See LOBOSA.

Amœbina, or NUDA. Order of Lobosa, including the amœba, whose body is a naked cell; hence the names.

Amœbodont Dentition. Molar teeth of mammals, that have the tubercles on their crowns alternately placed. These types have been distinguished by Cope: palæotheriodont, symborodont, bathmodont, loxolophodont, and hippodont.

Amœbosporidia. Sub-class of *Gregarines*, including the genus *Ophryocystis*, parasitic in *Tenebrionidæ* beetles. It is amœboid, multinucleate when large, and divides simultaneously into several uninucleate parts, which conjugate and encyst, and binarily produce six nuclei, two of which conjugate and produce one spore.

Amon Ra. Egyptian deity, originally the local god of Karnak, and probably the god of Harvest. The political ascen-

dency of Thebes, during the New Empire, over Egypt and its neighbors, added greatly to the luster of his worship, and the Egyptian religion never approached monotheism more closely than at this time. His cultus was the ruling one in all the Theban colonies, Ethiopia, Nubia, and the Oases.

Amontons, GUILLAUME, 1663–1705. Member of Academy of Science, Paris; wrote on the construction of meteorological instruments, the temperature and pressure of the air.

Amoor. River of eastern Asia. It rises in Mongolia, and after a long and circuitous eastward course along the boundary between Siberia and the Chinese Empire, empties into the Sea of Okotsk. Drainage area 500,000 sq. m. Length ab. 2800 m. By the treaty of Pekin, 1860, Russia secured the control of the stream and valuable maritime provinces at its mouth.

Amor. See EROS.

Amoretti, CARLO, 1741–1816. Librarian at Milan 1797; biographer of Leonardo da Vinci, 1784, and describer of Lakes Como, Maggiore, and Lugano, 1794.

Amorites. Tribe of Canaanites, who refused to allow Israel to pass through their territory, and were defeated by Moses, and again by Joshua. Reuben and Gad divided their lands.

Amorphozoa. See SPONGES and PROTOZOA.

Amos. Thirtieth Old Testament book, containing the prophecies of a herdsman of Judah, called to rebuke the idolatries and sins of the northern kingdom of Israel, ab. 800 B. C.

Amos, ANDREW, 1791–1860. Member of the first Criminal Law Commission and one of the first County Court judges of England; first Prof. of Eng. law in Univ. of London; Prof. of laws at Cambridge 1848; succeeded Macaulay as a member of the Governor-general's Council in India. *Ruins of Time*, 1856; *English Constitution in Reign of Chas. II.*, 1857.

Amotion. Turning out the legal proprietor of an estate in land, or a corporate officer from office.

Amoy. City and seaport of China, on Amoy Island. Pop. ab. 95,600.

Ampelidaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 11 genera and ab. 435 species, widely distributed throughout the temperate and warmer regions of the globe; commonly called the Vine Family.

Ampère. The practical unit of current strength, derived from the formula $[I] = [M]^{\frac{1}{2}} [L]^{\frac{1}{2}} [T]^{-1}$ by taking a new unit of length equal to 1,000,000,000 centimeters, and a new unit of mass equal to one 100,000,000,000th of a gram. The ampère is then 1-10 of a C.G.S. electromagnetic unit of current. Again from Ohm's law $C = \frac{E}{R}$, the ampère may be defined as that current which will flow in a conductor having a resistance of one ohm, if the two ends be maintained at a difference of potential of one volt. (C.G.S., centimeter-gram-second.)

Ampère, ANDRE MARIE, 1775–1836. French mathematical physicist, inspector-general Univ. Paris, prof. Polytechnic School, and member of the Institute. His most important contributions to science are: *Mathematical Theory of Games of Chance*, 1802; *Observations on Electro-dynamics*, 1822; *Theory of Electro-dynamic Phenomena*, 1826, and *Philosophy of the Sciences*, 1834. He also wrote on optics.

Ampère-hour. Quantity of electricity which flows in one hour when the current strength is one ampère. It is equal to 3600 coulombs.

Ampère, JEAN JACQUES ANTOINE, 1800–1864. French literary historian and critic; member of the Academy from 1847. *French Literature of the Middle Ages*, 1841.

Ampère's Hypothesis (OF MAGNETS). That each molecule of a magnetic substance is surrounded by a closed electric current, and that magnetization consists in rendering parallel the axes of all these currents. The resultant of the actions of such currents would be equivalent to that of a single current traversing the outside of the magnet. Thus by this hypothesis all magnetic phenomena may be referred to electro-dynamic principles.

Ampère's Laws (OF THE MUTUAL ACTION OF ELECTRIC CURRENTS). I. Two currents which are parallel and in the same direction attract each other. II. Two currents parallel but in opposite directions repel each other. III. When two currents cross at a point, they attract each other if they both approach the point or both recede from it. They repel each other when one approaches the intersection and the other recedes from it.

Ampère-turns. Product of the current strength by the number of turns of wire in a coil. See SATURATION, MAGNETIC.

Ampfing, BAVARIA. Here Lewis the Bavarian defeated and took prisoner his rival Frederic of Austria, 1322. Moreau began here his famous retreat, 1800.

Amphiaster. Spindle formed in the nucleus during cell division has, during the kataphase, a star at each end, composed of the metamorphosed chromatic mitom. The entire structure is termed the amphiaster or double star. Also, a form of sponge spicule consisting of two asters united by an axis.

Amphibia (BATRACHIA, SALAMANDERS AND FROGS). Cold-blooded Vertebrates, usually with naked skin, with lungs (and also gills, at least in the larva), with two chambers to the auricle in the adult and with a one-chambered ventricle to the heart. There are four pairs of aortic arches, the three anterior of which bear gills, the fourth being connected with the lungs. The eggs usually are fertilized and develop outside the body, the young having neither amnion nor allantois. There are four orders: *Gymnophiona*, *Labyrinthodonta*, *Urodela* and *Anura*. Scientifically, this group of animals may be classed with the fishes, the two classes being the phylum *Ichthyopsida*. Popularly they are regarded as reptiles, the terms Salamander and Lizard being used without discrimination, and applied to apparently similar representatives of the *Sauropsidan* and *Ichthyopsidan* branches of *Vertebrata*.

Amphibiotica. Tribe of *Pseudoneuroptera*, whose larvæ live in the water and breathe by tracheal gills. The May-flies (*Ephemeridæ*) and Dragon-flies (*Libellulidæ*) are included.

Amphiblastula. Peculiar blastula which is formed in the development of calcareous sponges. The segmentation of the sponge ovum results in a spheroidal mass of cells, that are large and granular at one end of this blastula, and are small and flagellated at its opposite pole. The next stage is the *pseudogastrula*, followed by a return to the *amphiblastula* condition, and then finally by the development of the *paragastrula*.

Amphibole. $RSiO_3$. Group of minerals, classed as anhydrous metasilicates, which agree closely in crystalline form and other physical properties, and in type of chemical composition, though differing considerably in details. Among the bases present, magnesium is the most constant; others are aluminium, calcium, iron, manganese, and the alkalies. The colors range from white to black, through shades of green. The most frequent varieties are actinolite, asbestus, hornblende, pargasite, and tremolite. Amphibole in its several forms is a common ingredient in crystalline rocks.

Amphibolidæ. Family of *Pulmonates*, of the sub-group *Basommatophora*.

Amphicœlia. See CROCODILIA.

Amphictyonic League. Association in ancient Greece, which met twice a year, once at Delphi and once at Thermopylæ. It comprised twelve tribes, each having two votes. These tribes seem to have combined in electing representatives to the great council, these being of two classes, the Pylagoræ and the Hieromnemones. The council treated many international questions, both regarding the temples of the gods held in common and also others, such as declaring war against Persia. Two sacred wars were waged under their sanction, one 585 B.C. and the other 346 B.C., Philip of Macedon being commander in the latter.

Amphidiscs. Spicules which surround the gemmules of *Spongella* and resemble two-toothed wheels united by an axis.

Amphigasters. Series of small leaves appressed to the under side of the stem in certain Liverworts.

Amphigastrula. Peculiar gastrula of sponges, which in the blastula stage is ciliated on one-half of the ovoid. It is this pole or hemisphere which is invaginated to form the gastrula.

Amphigenesis. See ALTERNATION OF GENERATIONS.

Amphilestes. One of the earliest marsupial mammals, a jaw and teeth of which have been found in the Stonesfield slate of the English Jurassic rocks.

Amphimorphæ. Order of birds including the flamingoes. See LAMELLIROSTRES.

Amphineura. Group of animals including *Chiton*, *Chætoderma* and *Neomenia*.

Amphion. Son of Zeus and Antiope. King of Thebes. He built the wall of Thebes by aid of a magic lyre given him by Hermes.

Amphioxus. See LEPTOCARDII.

Amphipleura. See ALLOPOLA.

Amphipneusta Molluscs. See STYLOMMATOPHORA.

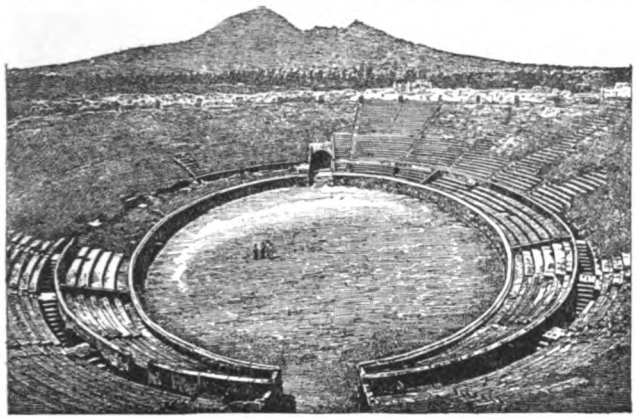
Amphipoda. *Arthrostraca* with laterally compressed body, gills on the thoracic feet, and two sorts of feet on the abdomen, the anterior pairs being adapted for swimming, the posterior ones for springing, as seen in the Sand-hoppers or Sand-fleas. There are three tribes, *Læmodipoda*, *Crevettina*, and *Hyperina*.

Amphipolis. City of Thrace, founded by Athenians 437 B.C., seized by Spartans 424 B.C.

Amphiprostyle. In classic architecture, a temple having a range of columns at each end, but none at the sides.

Amphisbæmidæ. Family of *Brevilinguia* including serpent-like lizards with rudimentary fore limbs, no hind limbs, and minute covered eyes. The body is marked by furrows which give a tesselated appearance. They inhabit S. America and s. Europe. See ANNULATA.

Amphitheater. Building or apartment of a circular or elliptical plan, surrounded by seats on all sides, and affording a view of the central space, or arena, in which the spectacle was presented. The Colosseum at Rome was the most famous



Amphitheater at Pompeii.

and extensive example, being an ellipse of ab. 600 ft. by 500. The Madison Square Garden, in New York, is properly an amphitheater.

Amphitherium. One of the earliest marsupial mammals whose teeth and jaw have been found in the Stonesfield slate of the English Jurassic rocks.

Amphitrite. Wife of Neptune and goddess of the sea, especially the Mediterranean.

Amphitryon. In mythology, spouse of Alcmene and king of Tiryns.

Amphiuma. See DEROTREMA.

Amphora. Ancient pottery vessel used for holding wine and other liquids; slender and cylindrical, tapering to a narrow neck with handles; tapering also to a point at the base, so that it could be set upright in the sand or mould of a cellar, or leaned against a wall. Also smaller glass and pottery vessels of the same shape.—In botany, lower part of fruit known as pyxis, as that of Portulaca and Plantain.

Greek Amphora Late Style

Amplitude. Distance through which a vibrating particle or body moves on either side of its position of rest. Also the radius of the circle of reference of a simple harmonic motion (q.v.).

Amplitude of a Star. Distance from e. or w. point of the horizon to the foot of the vertical arc passing through the body.

Ampula. Ancient bellied or globular form of bottle in pottery or glass, used mainly for holding the oil required after gymnastic exercises or bath.

Ampullæ. (1) Of Echinoderms. See AMBULACRAL SYSTEM. (2) Small sacs (see RHAGON) lined with choanocytes, formed on the course of the canals (incurrent and excurrent) that ramify through a sponge. The water is drawn in by the activity of the flagella of the choanocytes, which cells take their nutriment and oxygen from the water as it passes.

Amputations. Between 350 B.C., when the Hindoos performed this operation, and ab. 1550, this branch of surgery showed little advance and was a procedure justly dreaded on account of the difficulty of arresting the hæmorrhage. Hot oil or pitch, or a heated iron, were the only measures used for this purpose until the tourniquet appeared, an instrument which surrounds a limb and compresses the artery supplying it. Modifications of this are still in use, and are in fact but little improved upon. The operation is performed for the removal of hopelessly injured and diseased limbs or members. Pressure upon the artery is always exerted on the body side of the incision and the arteries tied or twisted before its release, the flaps made so that when sewn together a surface covered with skin is left, all the injured or diseased tissue removed, and the wound dressed antiseptically. The nearer the trunk a limb is amputated and the greater the age above ab. 30 years the greater the danger. As little as possible should be removed, as the shorter an artificial limb is the more serviceable it is. Amputations of fingers or toes may be performed without the tourniquet, the arteries being too small to cause a serious loss of blood before being tied. The removal of small redundant parts is usually done with an écraseur or heated platinum wire loop.

Amrita. In Hindoo mythology water of immortality, obtained by churning the ocean. Also, food of the gods.

Amrith. Ancient Marathus in n. Syria; most important site of Phenician architectural remains, mainly discovered and made known by E. Renan, *Mission de Phénicie.*

Amritsar. City of British India, between the Bias and Ravi rivers; principal trading center of the Punjab. Pop., 1891, 136,500.

Amru-el-Kais. Arabian poet of 7th century. We have a poem of his which was one of the famous seven *Moallakat*, so called because they were suspended in the Kaaba at Mecca.

Amsdorf, NIKOLAUS VON, 1483–1565. German reformer, one of Luther's helpers; remembered chiefly for his strange hyperbole, "Good works are hurtful to salvation."

Amsterdam. Capital of Holland and its most important commercial city, on an arm of the Zuyder Zee. Lying in great

part below the sea level, it is protected by dykes. It is laid out in semicircular form, facing the shore. Pop., 1891, 417,539.

Amsterdam. City of Montgomery Co., N. Y., on Mohawk River, 33 m. n. w. of Albany. Pop., 1891, 17,336.

Amsterdam Museum AND GALLERY. The latter is mainly confined to Dutch and Flemish paintings, and leads the world in this department; its most famous masterpiece is Rembrandt's *Night Watch.* The Museum has a fine arrangement of restorations of historic apartments, with complete furniture and decorations, for a number of different periods, and a mass of other interesting materials.

Amsterdam, TREATY OF. Concluded Aug. 4, 1717, between France, Russia, and Prussia; France to mediate between the two latter and Sweden.

Amulets. Objects worn as charms or preventives against witchcraft, sickness, accident, and other evils. Their use was common among primitive peoples, and the custom has come down to our times. The spur of red coral is a familiar illustration, being in current use, with other objects, among the people of s. Italy as a charm against the evil eye. Prof. Belluchi of Perugia has shown, by means of his collection of Italian amulets, that the peasants of the Campania use the same objects as charms as did their ancestors of prehistoric times. Amulets were much used by the ancient Egyptians and among the Greeks and Romans, and traces of them in the early Church exist. They are common to-day among all Mohammedan peoples, who wear charms inscribed on paper, stone, or metal, with sentences from the Koran. In China, children are frequently provided with amulets, inscribed with the *Pat Kwa*, or "Eight Diagrams," or an image of the God of Longevity, with the object of inviting long life.

Egyptian Amulet.

Amurath I. See MURAD I.

Amygdalin. $C_{20}H_{27}NO_{11}$. Glucoside found in bitter almonds, peach stones, and cherry stones; decomposed by water with the formation of benzaldehyde, dextrose, and hydrocyanic acid.

Amygdaloid. Igneous rock from lava, containing air-cells formed by steam.

Amyl. C_5H_{11}. Group or radical which exists combined with hydroxyl in amyl alcohol, $C_5H_{11}.OH$. Known in various forms, of which the most common is the so-called iso-amyl, present in the amyl alcohol of fusel oil.

Amyl Acetate. $C_5H_{11}.(CH_3.COO)$. Liquid boiling at 148° C. and prepared by the action of amyl alcohol upon acetic acid in the presence of a water-absorbing agent; main constituent of the pear oil of trade. It has a pleasant odor and taste.

Amyl Alcohol. $C_5H_{11}.OH$. Amyl hydrate. Eight isomeric amyl alcohols are possible; three are present in fusel oil. The most common is the iso-amyl alcohol $(CH_3)_2:CH.CH_2.CH_2.OH$. Poisonous liquid with a disagreeable odor, boiling at 131° C.

Amyl Bromide. $C_5H_{11}.Br$. Combination of one of the amyl radicals with bromine. The common one is iso-amyl bromide, prepared from the alcohol and phosphorus bromide.

Amylene. C_5H_{10}. Unsaturated hydrocarbon, known in various isomeric forms; liquid with low boiling point.

Amyl Ether. $C_5H_{11}.O.C_5H_{11}$. Oxide of the amyl group, prepared by action of amyl alcoholate upon amyl iodide.

Amyl Hydrate. See AMYL ALCOHOL.

Amyl Nitrite. $C_5H_{11}.NO_2$. Yellow liquid prepared by the action of nitrous anhydride upon ordinary amyl alcohol; used in pharmacy, and also in the preparation of diazo compounds; prescribed in medicine in cases of heart-failure.

Amyloid. (1) Amorphous substance produced by action of strong sulphuric acid upon cellulose. Parchment paper consists of paper changed upon the surface into amyloid. (2) In botany, an organic vegetable substance resembling starch in its chemical reactions.

Amyloplasts. Colorless protoplasmic bodies occurring in living plant cells, in which starch grains are developed; also known as starch-forming corpuscles, leucoplastids, and amylogenic bodies.

Amyl Sulphuric Acid. $C_5H_{11}.OSO_2.OH$. Produced by partial neutralization of sulphuric acid by amyl alcohol.

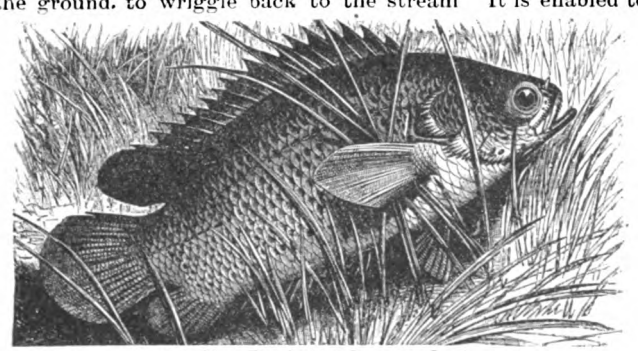
Amyot, JACQUES, 1513–1593. Bp. of Auxerre; French translator of Plutarch and other Greek authors.

Amyot, JOSEPH MARIE, 1718–1793. French Jesuit, missionary to China 1750. He prepared a *Life of Confucius*, a *Tartar-Mantchu-French Dictionary*, 1789–90, and by other writings and translations did much to make China better known in Europe.

Amyrant, MOISE, 1596–1664. French Reformed theologian. His *Treatise of Predestination*, 1634, set forth a modified view which was repeatedly attacked as heresy, but adopted by many English and American Calvinists.

Anabaptists. Name given, disapprovingly, to those who denied the validity of infant baptism, especially the fermenting continental sects of the 16th century, some of which ran into fearful excesses of lust and cruelty. Jeremy Taylor, in his *Liberty of Prophesying*, 1647, excluded them, as dangerous to any state, from his scheme of toleration.

Anabas. Climbing Perch, said to climb trees to ht. of 7 ft., when heavy rain is falling, and then, dropping to the ground, to wriggle back to the stream. It is enabled to

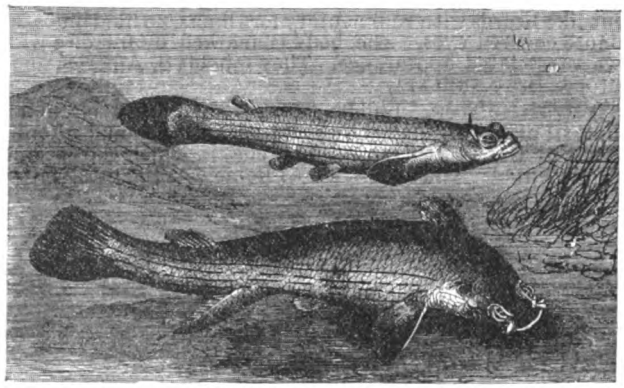


Climbing Perch (*Anabas scandens*).

crawl by means of the lower edges of its gill covers. The branchyal bone is developed into a labyrinth of plates inclosing vascular chambers that act as lungs. See ACANTHOPTERI.

Anabasis. Greek work (1) of Xenophon, describing the attempt of Cyrus the Younger, and the retreat of the 10,000; (2) of Arrian, on Alexander's campaigns.

Anableps. Genus of the *Cyprinodontidæ*, or Mud Minnow, largest of the family, attaining a length of a foot. They swim at the surface, as do the Top Minnows, the upper half of each eye out of water. A horizontal partition divides each eye into



Anableps tetrophthalmus.

two parts, one adapted for vision in air, the other in water. These fishes resemble some of the other Mud Minnows (*e.g. Gambusia*) in bringing forth their young at an advanced stage of development. They are viviparous, carnivorous, and inhabit rivers of tropical parts of N. and S. America.

Anacanthini. Order of Physoclist fishes, with soft fins; usually the pelvic fins are jugular. There are three sub-orders: *Synentognathi*, *Heterosomata*, and the *Gadidæ*. To the first belongs the family (*Scomberosocidæ*) of Gar-fishes and Flying-fishes. The Gars (*Belone*) or Bill-fish are remarkably slender and have the toothed jaws produced into a long slender snout. The Flying-fish belong to the genus *Exocœtus*. These leap from the water by a smart stroke of the tail and, spreading their long pectoral fins, are able to sustain and prolong the leap for a minute or longer. To the second group belong the Flat-fishes (*Pluronectidæ*), as the Plaice, Sole, Flounder, Halibut. They swim near the bottom on one side, and this has caused the lower eye to twist around to the upper side, the process taking place gradually in the young. To the last group belong the Cod-fishes, by some authors placed with the *Acanthopteri*.

Anacardiaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 56 genera and about 430 species, scattered through the tropics and the regions just beyond, both n. and s.; Sumach Family.

Anacharsis. Scythian prince, who came to Athens in quest of knowledge ab. 594 B.C.; was admitted to citizenship, traveled, and was slain on his return home. His *Epistles* are spurious. For "Anacharsis the Younger," see BARTHELEMY, J. J.

Anachronism. Error in time, common to poets and artists, as when Dutch painters represent biblical characters with guns and in the dress of A.D. 1600.

Anacletus. I. Bp. of Rome before 100. II. (PIETRO PIERLEONI), anti-pope 1130–38, opposed to Innocent II.

Anaconda. Originally, large python-like serpents of both hemispheres; now, genus *Eunectes*, largest of the *Boidæ*. It lives in tropical America, and subsists on large birds and small

Anaconda.

mammals. It is brown in color, with a double row of black blotches on the back and smaller black rings on the sides.

These serpents appear much longer than they are, 40 ft. being an extreme.

Anacreon, ab. 560–ab. 475 B.C. Greek lyric poet at Teos, Samos, and Athens; a voluptuary, according to tradition, which his poems attest; these are graceful, but not always admirable for poetic feeling. Many odes attributed to him are spurious.

Anadyomene, or VENUS RISING FROM THE SEA. Famous picture of Apelles, sold to Augustus for 100 talents.

Anadyr. River of n. e. Siberia, flowing e. into Behring Sea.

Anadyr Gulf. Arm of the Pacific, penetrating n. e. Siberia.

Anæmia. Condition in which the blood is impoverished, lacking principally in the number of its red blood-corpuscles; characterized by great paleness and loss of strength. It may follow insufficient nourishment, any acute disease, syphilis, rheumatism, gout, disease of the spleen, presence of an animal parasite (the Ankylostemee duodenale or Dochmius duodenale) in the duodenum, or may occur without any apparent reason and lead to a fatal termination. The parasitic form is known as brickmakers', miners', or tunnel anæmia, and the last variety as malignant anæmia. In the ordinary forms a generous diet, iron, and cod-liver oil will usually improve the condition, the proper special treatment for the disease being followed. Miners' anæmia is cured by vermicides, while malignant anæmia usually resists all treatment. An insufficient blood-supply to an organ or tissue is also termed anæmia.

Anærobiotic. Bacteria whose vegetation is promoted by the exclusion of oxygen.

Anæsthesia. Loss or diminution of the sense of touch. In medicine, a state of insensibility to external impressions and to pain. It may be caused by disease or artificially brought about by anæsthetics.

Anæsthetics. Remedies which by inhalation or direct contact with a part abolish sensibility to pain. In the latter class are included extreme cold and a number of vegetable alkaloids, of which cocaine is the most important and most commonly employed. In the first class are ether, chloroform, nitrous oxide or laughing gas, and several substances which resemble ether and chloroform, but are rarely used on account of their dangerous properties. By the inhalation of these bodies the person is thrown into a sort of sleep, in which all consciousness is abolished and the most difficult operations undertaken, in some instances lasting hours. Ether and chloroform are employed when the operation is likely to last long, and nitrous oxide for the extraction of teeth and other short but painful operations. The two former are almost universally used to relieve the pains of childbirth: this was for some time opposed by certain sects as enabling women to avoid the penalties inherited from Eve. Under proper conditions and in the hands of competent persons the danger of death from anæsthetics is so slight that they are employed often in making examinations only moderately painful. The number of deaths from ether is only one in nearly 17,000 administrations, from chloroform one in about 3,800, and from nitrous oxide death is almost unheard of. Chloroform and nitrous oxide should not be administered to persons having heart disease, nor ether to those afflicted with Bright's disease. Cold is employed either by applying ice, or freezing the surface by spraying ether, or any very volatile substance, upon it; but is seldom used, on account of danger of freezing the parts too deeply and causing gangrene. In any event it is applicable only for the extraction of teeth, opening of an abscess, etc. Cocaine is very largely used in slight operations upon the eyes and for other unimportant operations where it can be injected directly into the parts to be incised.

Anagnostes, JOANNES. Author of an account of the storming of Thessalonica by the Turks 1430, and a *Monodia* or lamentation for that misfortune.

Anagram. Word or sentence obtained by transposing the letters of another, as "James Stuart"—"a just master"; often superstitiously invested with importance.

Anagrams. A game played with printed letters of the alphabet. Each player forms a word, and then, mixing the letters composing it, gives them to his right hand neighbor, who is required to arrange them again in their former order.

Anahuac. Great central plateau of Mexico, a part of the Cordilleran plateau of N. America. Its elevation is 6,000 to 9,000 feet, and it is crowned by mountain ranges and volcanic peaks, the highest of which is Popocatapetl, 17,720 ft.

Anakim. Giants in s. of Palestine 1500 B.C.; called Sons of Anak, Num. xiii. 28.

Anakinesis. See PROPHASES.

Anal Appendages. Belonging to last segment of abdomen of insects, modified as forceps, antennæ, etc.

Analcite. $Na_2Al_2Si_4O_{12}+2aq$. Zeolitic mineral, resembling garnet in crystalline form.

Anal Gland. (1) Uropygial gland of birds. (2) Scent glands near the anus in certain mammals, *e.g.* the skunk. (3) Glands in similar position in other animals, as snails.

Anallantoideans. Fishes and Amphibia collectively, their embryonic forms being characterized by the absence of an allantois; more usually designated as *Ichthyopsida.*

Analogous Pole. That part of a pyroelectric body which shows positive electricity when the temperature is rising, and negative electricity when it is falling. The antilogous pole is that part which becomes negative by being heated and positive by being cooled.

Analogous Variation. See PARALLEL VARIATION.

Analogy. In common use, accidental resemblances; in logic, often a form of inductive inference. It is better to say that induction is founded upon essential, and analogy upon accidental qualities and resemblances. The former gives probability and the latter only rational possibility. Parables are good illustrations; they are not arguments, but means of making a doctrine intelligible. As Jevons remarks, analogy "denotes not a resemblance between things, but between the relations of things. A pilot is a very different man from a prime minister, but he bears the same relation to a ship that the minister does to the state, so that we may analogically describe the prime minister as the pilot of the state. There is a real analogy between the tones of a monochord, the sages of Greece, and the gates of Thebes, but it does not extend beyond the fact that they were all seven in number." *E.g.*, the argument from the existence of terrestrial to that of planetary inhabitants has no cogency, and at best can only suggest a rational possibility.

Analogy. In Zoology, as opposed to homology; resemblance in function, and therefore in superficial structure of organs. Thus the wings of insects and of bats are analogues. See HOMOLOGY.

Analogy in Language. Tendency to reduce variety to unity by bringing exceptional or divergent forms to a common standard. The old plural of English "book" (*bōc*) was *bēc*, and would now be "beek"; but analogy with other plurals made it "books." Another form of this tendency is so-called "popular etymology," by which brenstone (*i.e.* burn-stone) became brimstone.

Anal Plates. Of Echinoderms, those surrounding the proct. Of snakes, see ANAL SCUTE.

Anal Pouch. Sac in badgers, above the anus, in addition to anal glands.

Anal Respiration. Seen in the lower (entomostracous) *Crustacea*, in which the gut next the proct is rhythmically pulsatile, drawing in and expelling water.

Anal Scute. Last ventral plate of a serpent, in front of the proct.

Anal Spurs. Rudimentary legs of boas and pythons.

Analysis. Opposite of synthesis. The two, in common life and the physical sciences, mean taking apart and putting together. In philosophy they describe the method of acquiring and developing knowledge. Analysis is deductive method, which involves definition, division, and probation; it renders explicit what is implicit in a doctrine. Synthesis describes inductive method, which involves observation, hypothesis, and verification by scientific principles. It adds to knowledge, while analysis only unfolds its implications.

Analysis. In chemistry, processes by means of which the constituents of a given substance are determined. There are two principal subdivisions, QUALITATIVE and QUANTITATIVE (q.v.).—In botany, examination of a plant with a view of determining its name and systematic position.

Analytic Function. One expressed in analytic symbols.

Analytical Geometry. Application of the notation and processes of Algebra to the investigation of the properties of form. Form, as lines, surfaces, etc., is considered as produced by successive positions, referred to fixed elements. The law governing this succession expressed in algebraic symbols forms the equation of the locus (or form). Deductions by algebraic processes from this equation give the properties of the locus. This application of Algebra was introduced by Descartes 1636.

Analytical Trigonometry. Science treating of the trigonometric functions of all angles and their inverse functions. The fundamental formulas derived geometrically are

$$\left.\begin{array}{l}\text{Sin}\,(A \pm B)=\text{Sin}\,A\,\text{Cos}\,B \pm \text{Cos}\,A\,\text{Sin}\,B\\ \text{Cos}\,(A \pm B)=\text{Cos}\,A\,\text{Cos}\,B \mp \text{Sin}\,A\,\text{Sin}\,B\end{array}\right\},$$

where A and B are any two angles. From these formulas, through algebraic transformations and the interrelation of the

trigonometric functions, an indefinite number of subsidiary formulas may be derived.

Analyzer. Optical instrument for detecting and examining polarized light. Any form of polarizer may be used, *e.g.* a reflector of glass, a Nicol's prism, or a tourmaline plate.

Anam, or COCHIN CHINA. Country of s. e. Asia, bordering on the China Sea, s. of China and e. of Siam; now under a French protectorate. The n. and s. parts are low and level, the middle portion mountainous. Area ab. 27,000 sq. m.; pop. ab. 5,000,000.

Anamorphosis. Objects when seen reflected from cylindrical or conical mirrors always seem more or less distorted, the amount depending upon the dimensions of the mirror. It is possible to reverse this process and to construct an image of such a shape that when seen reflected from a distorting mirror the object shall appear in its normal proportions. Anamorphosis is this restoration.

Ananias. I. Disciple of Jerusalem, who, having hypocritically endeavored to unite the praise of liberality with the reality of covetousness, was, with his wife Sapphira, struck dead at the word of St. Peter. II. Christian of Damascus, who restored Paul's sight. III. High priest A. D. 48, and persecutor of St. Paul.

Anaphase. See PROPHASES.

Anarchism. Project of social reorganization in which the authority of government would be reduced to a minimum, or entirely eliminated, leaving pure individualism, modified only by voluntary association, subject to dissolution or revision.

Anarchist. One who believes in the abolition of government. Most anarchists favor the overthrow of existing governments by forcible revolution. In a community where such is the prevailing doctrine of this class, to publish of one that he is an anarchist has been held libelous.

Anarthropoda. Division of *Annulosa*, including *Gephyrea*, *Annelida*, and *Chætognatha*.

Anasarca. See DROPSY.

Anastasius. I. Pope 398–402, condemned Origen and the Donatists. II. Pope 496–498, who attempted to reunite East and West, and was called a heretic. III. Pope 911–913. IV. Pope 1153–54.—Another of this name was antipope 855.

Arteries anastomosing.

Anastomosis. In anatomy uniting of branches in their course after having left the common stem. A rough net-work is the result of this interlacing.—In Botany the uniting of the veins of leaves.

Anatase. TiO_2. Titanium oxide of same composition as rutile, but crystallizing in acute tetragonal pyramids.

Anathema. Orig. devoted to a god; thence accursed, given over to destruction: word used several times by St. Paul.

Anatidæ. Family of *Anseres* having the hallux fringed with a membranous lobe. The *Anserinæ* (geese) and *Anatinæ* (ducks) are the principal subfamilies. The swans are intermediate, and are distinguished for size and for length of neck, which has an increased number of vertebræ and not extra lengthened vertebræ as in most long-necked birds. Africa alone has no swans, Australia has a beautiful black swan. Of white swans *Olor* has a straight neck and in *Cygnus* it is S shaped.

Shoveler Duck (*Anas clypeata*).

Anatinæ (DUCKS). Subfamily of *Anatidæ* having a broad long bill with sieve-like lamellæ, narrow tails and considerable variety of coloration and sexual differentiation. The males have a swelling on left side of trachea near the fork of the bronchi, known as the labyrinth (*Bulla ossea*). In most sea ducks it is fenestrated. Tree ducks (*Dendrocygna*) live in the tropics, and nearly related is the shelldrake (*Tadorna*), whose legs are long and central, without lobes on the hind toe; they inhabit the shores of the n. Atlantic. The eggs are laid in burrows in the sand-dunes. They are "farmed" by the Danes, who take their eggs and down. River ducks have no lobe on the hind toe, such as is characteristic of sea ducks. The Eider-duck, exceptionally, has no fenestra in its labyrinth. They breed in Arctic and sub-Arctic regions, being specially protected on the coast of Norway. From Greenland are exported 6,000 lbs. of eider-down yearly, representing 72,000 nests. The Labrador duck became extinct 1878, and museum specimens are twice as rare as of the Great Auk. Sea ducks live on molluscs, but the mergansers feed on fish, to catch which the bill is narrow, long and toothed. The head is crested.

Anatolia, ASIA MINOR. Now a Turkish pashalic. Area 208,327 sq. m.; pop. 9,125,000.

Anatolius OF BERYTUS. Jurist, prætorian præfect of Illyricum, vicar of Asia 339 under Constantius.

Anatolius. Prof. of law at Berytus, d. 557 in an earthquake. He assisted in compiling Justinian's Digests.

Anatolius. Greek hymnist, probably of 9th century; supposed by Dr. Neale to be patriarch of Constantinople 459.

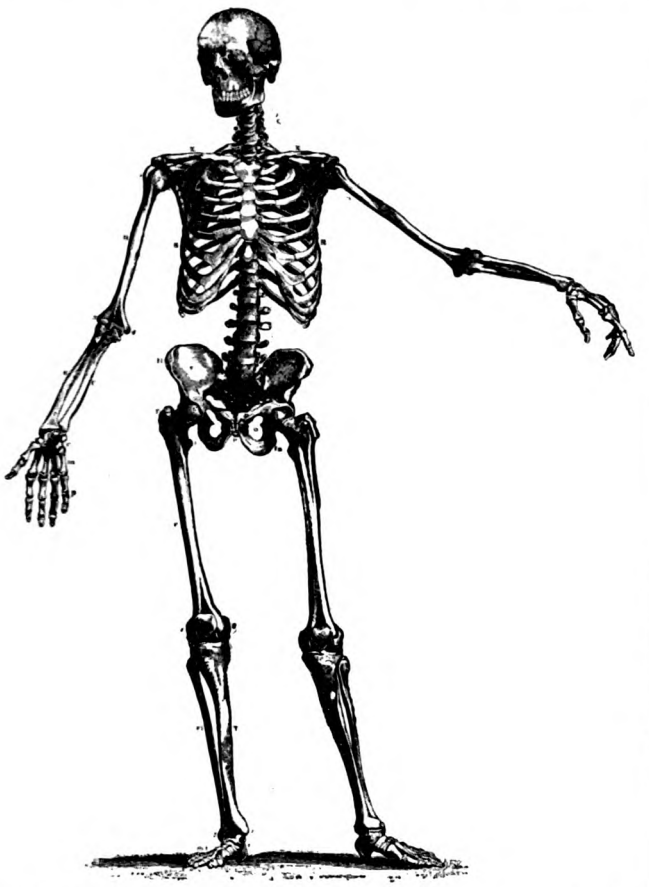
Anatomy. That branch of Morphology which treats of the structure of organisms. When studied on one or a few forms it is special anatomy. If a series of related forms are studied in their true classificatory relations, it is systematic anatomy; if the homologous and analogous organs are studied systematically one by one, it is comparative anatomy. The study of the organs and mechanisms constitutes gross anatomy: that of the tissues is Histology, minute or microscopic anatomy. Hæckel divides anatomy into TECTOLOGY and PROMORPHOLOGY (q.v.). See OSTEOLOGY, MYOLOGY, SPLANCHNOLOGY, ARTHROLOGY, NEUROLOGY, ANGEIOLOGY.

Anatomy, HUMAN. Attempts have been made to trace the study of the parts of which the body is formed to a very remote period, but if any information on the subject existed prior to Aristotle, it was vague and of little value. To Hippocrates has been given undeserved credit in this line, for he knew little or nothing of it. Aristotle dissected animals freely and man in a few instances; the knowledge he obtained in this way was singularly exact for the times; some of the terms he used are still in vogue.

Between his time and that of Galen some slight advances were made, chiefly by Eristratus and Herophilus of the Alexandrian school. Galen, ab. 130–201, described nearly all the bones and muscles, established the fact that the arteries contained blood, not air, as had been previously believed, gave accurate accounts of various organs, and founded a system of nomenclature, many terms of which still exist. After his death nothing of note was done until the 14th century, when Mondino dissected human bodies in Bologna and cleared up many points previously obscure. His influence rendered Italy the center of anatomical study, a position it maintained for near three centuries. Vesalius, a Belgian, who received his early education in France, was the first to produce a systematic treatise and is justly regarded as the "father of modern anatomy." Prominent later teachers were Eustachius, Columbus, Ingrassias, Falloppio, and Fabricius. In 1619 William Harvey, who had studied in Italy, announced his discovery of the circulation of the blood. The microscope added impetus to the study, and Albinus of Leyden produced plates which for beauty and accuracy have never been surpassed, covering almost every point of importance. From his time until the discovery of the compound microscope in 1830 little advance was made. Since then microscopic anatomy, or histology, has occupied the attention of an army of students, and each year fresh advances are made and difficult problems demonstrated. It has been found that a proper knowledge can be obtained only by tracing all portions of the body to their commencements in the embryo, and it is chiefly in that direction that investigators are now working. As a result of these labors some light is being thrown, *e.g.*, on the questions of why one ovum should develop into a male and another into a female, and also on the changes which occur in the tissues in disease and the best methods of combating them. The ultimate elements into which all tissues can be resolved are cells which in man and most of the higher animals are from $\frac{1}{200}$ to $\frac{1}{2500}$ of an inch in diameter, vary in form according to the parts in which they are found, and can reproduce themselves indefinitely under proper conditions. Until recent times much difficulty in obtaining human bodies for dissection existed, the only material obtainable being those of executed criminals and the results of

grave robbery. But now in all civilized countries the laws direct that the unclaimed bodies of those dying in prisons and public institutions are to be turned over to properly authorized persons and colleges.

In pathological anatomy, the examination and study of diseased organs, great advances have been made during the



past half century; it has been of the greatest value in affording increased knowledge of disease-processes and their prevention and relief. Comparative anatomy is the study of the structure of the lower animals and their relations to man. The various organs, tissues, and structures of the body are described under their titles.

Anaxagoras. Ab. 500–428 B.C. Greek philosopher, b. in Asia Minor, a resident in Athens from ab. 480 till banished 450; friend of Pericles and reputed master of Socrates and Euripides. He may be regarded as the first great man of science, for he anticipated many doctrines supposed to be modern, and had some idea of the conservation of energy. He taught that air is a substance, the sun a mass of blazing metal, and eclipses due to natural causes, and that all things have existed from the beginning, but in infinitesimally small fragments, from which "nebulæ" the world had developed. Man and the other animals sprang from the warm and moist clay. He explained the mechanical nature of the physical order and the indestructibility of matter, and called chance the name for causes not perceived by the human intellect.

Anaxandrides. Athenian poet of the Middle Comedy, ab. 376 B.C.; first to introduce love intrigues.

Anaximander. Ab. 611–ab. 547 B.C. Greek philosopher, successor of Thales in Ionia. He made advances in natural science, is said to have invented the sun-dial and discovered the obliquity of the ecliptic, and stated clearly the doctrine of evolution: the earth and heavenly bodies had developed from a uniform substance, land animals from those of the sea, and man from the beasts.

Anaximenes. Greek philosopher of Ionia, ab. 500 B.C. He taught that all things are developed from air.

Anaximenes, 4th century B.C. Greek historian and rhetorician, b. at Lampsacus; companion of Alexander. Fragments of his histories remain, and a rhetorical treatise ascribed to Aristotle is regarded as his.

Anaxonia. Animals like the amœba, having no axis.

Ancelot, JACQUES ARSENE FRANCOIS POLYCARPE, 1794–1854. French poet and dramatist; academician 1841. *Louis IX.*, 1819; *Olga*, 1828.—His wife, MARGUERITE VIRGINIE CHARDON, 1792–1875, wrote novels and plays.

Ancestor. In law, the person, whether progenitor or not, from whom an estate descends to the heir.

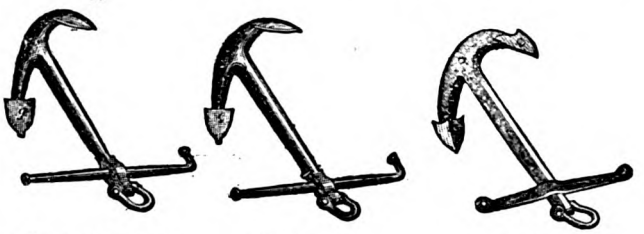
Ancestor Worship. Basis of native religion of the Chinese, and an important element in most primitive religions, being regarded, in its broadest sense, by Herbert Spencer, as "the root of every religion." Sanctified by Confucius and his school, it is practiced at the present day throughout China, Korea, and Japan.

Ancestral Tablets. Of wood, inscribed with the name of the deceased; erected and worshiped by the Chinese; regarded as abiding-places of the souls of the dead; sometimes painted and gilded. Their conservation and worship is a most important filial duty in China. They are kept both in private houses and in special temples called "ancestral halls."

Anchises. Trojan noble, beloved of Venus, by whom he became father of Æneas; boasting of his relations with the goddess, he was struck with blindness; borne by his son from burning Troy.

Anchor. Heavy iron forging (sometimes steel-casting),

1.



Common Anchor. Admiralty's. Rodger's.

with stock, shank, and flukes, for holding a ship in harbor and elsewhere; classified as Boat, Bower, Kedge, Sheet, and Stream. Some of the principal ones are the Aylien, Honiball, Lenox, Mitcheson, Porter, Rodger, and Trotman.—In archi-

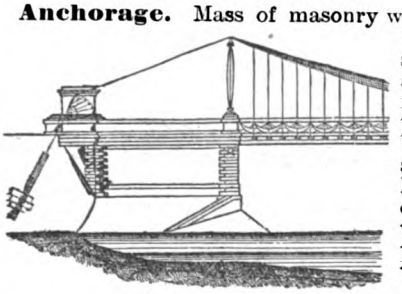
Trotman's Anchor at Work.

Smith's Stockless Anchor.

tecture, ornamental termination of an iron rod extending through a wall, chimney, or other construction of masonry, to prevent it from spreading from internal pressure or inclining from the perpendicular by the force of the wind or any other cause. In mediæval architecture, often an elaborately decorative feature.

Anchoracephala. See CIRRIPEDIA.

Anchorage. Mass of masonry which resists the pull of the cables of a suspension bridge. The cables are carried through the masonry and attached to heavy iron plates imbedded in it. The shore abutments of a cantilever bridge are also called anchorages, as they resist the upward pull of the shore arm of the bridge.



Anchorage.

Anchor Ice. Ice which forms in the shape of needles in swift waters, and then sinks, often causing obstructions in streams and mill flumes. In cold climates brooks sometimes overflow their banks owing to collections of anchor ice in their beds. See GROUND ICE.

Anchorites. Religious recluses, hermits. Pagan persecution drove many into deserts; others withdrew from the corruptions of society. This way of life became common in Egypt and Syria in the 3d century.

Anchovy. *Engraulis enchrasicholus.* Small fish of herring family. It has green-blue back and a forked tail. Anchovy

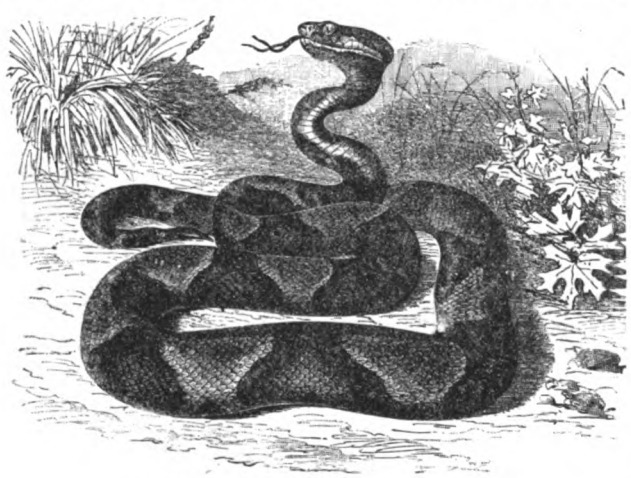
Anchovy.

sauce is made by macerating the fishes in water, digesting the mixture, adding red pepper and then filtering.

Anchylosis. Stiffening of a joint from injury or disease.

Ancillon, JOHANN PETER FRIEDRICH, 1767–1837. Pastor in Berlin; Prussian foreign minister 1831; anthor of a French work, *Revolutions of Europe*, 4 v., 1803–5.

Ancistrodon. Genus of American *Solenoglpha*, or poisonous snakes, including *A. contortrix*, the highland copperhead of the South. It has a loreal plate and 23 rows of scales. When cold weather comes, several bunch together. The female bears seven young alive. They are ferocious. *A. piscivorous* is the Water Moccasin of the South, more dreaded than the Rattlesnake, in that it grows to a large



Moccasin Snake (*Ancistrodon contortrix*).

size (4 ft.), is very poisonous, attacks at the slightest opportunity, and strikes without warning. In Brazil is an allied form, *Trigonocephalus*, from whose bite many laborers die annually. Another genus, *Caudisona*, includes the *Massasauga* or Black Rattler of Ohio and adjacent region. It has rudimentary rattles, and lives in the holes of the Prairie-dog.

Ancohum. Peak of the Andes, in Bolivia, ht. 21,286 ft.

Ancona. City of Italy, on the Adriatic: annexed to the Papal States 1532; held by the French 1832–38; taken from the revolutionists by the Austrians June 18, 1849. Here the papal forces surrendered to the Sardinians Sept. 29, 1860. Pop.,1891, 48,572.

Ancren Riwle. (Rule of Female Anchorites, or Nuns.) Treatise on monastic life in Semi-Saxon, ab. 1200.

Ancyra. See ANGORA.

Andalusia. S. part of Spain, including the ancient Moorish kingdoms of Granada, Cordova, Seville, and Jaen. It embraces 8 provinces. Area 33,800 sq. m.; pop. ab. 3,500,000.

Andalusite. Al_2SiO_5. Basic orthosilicate of aluminium, occurring in several modifications. When transparent and pure in color, it finds use as a gem. A variety showing in cross-section spot of one color regularly arranged on a differently colored background is called chiastolite or macle.

Andaman Islands. In Bay of Bengal; penal colony of India. The natives, among the lowest in development on the earth, are a tribe of Malays of dwarf-like stature, black skin, delicate features, strong muscles, beardless, and of nomadic habit. They construct temporary huts and wear no clothing. They are supposed by some to represent the remnants of a primitive race of man which inhabited a continent now lost under the Indian Ocean and called Lemuria.

Andante. A time-designation in music indicating that a piece is to be sung or played at moderate speed.

Anderledy, ANTONIUS, 1819–1892. General of the Society of Jesus from 1884, succeeding Beckz, whose assistant he had been from 1870.

Andersen, CARL, 1828–1883. Danish poet.

Andersen, HANS CHRISTIAN, 1805–1875. Danish novelist and poet, beloved of children in all lands for his fairy tales, 1835 and later. *The Improvisator*, 1834, and his other books for adults, are less widely known.

Anderson, LARS (LAURENTIUS ANDREÆ), 1480–1552. Swedish reformer; chancellor of Gustavus Vasa 1524, and translator of the Bible 1526–41.

Anderson, MARTIN BREWER, LL.D., 1815–1890. Ed. N. Y. *Recorder*, 1853, pres. Univ. Rochester 1853–88.

Anderson, MARY, b. 1859. American actress. She appeared in N. Y. 1875, and in London 1883. In 1890 she became Mrs. A. F. de Navarro, and left the stage.

Anderson, RASMUS BJÖRN, b. 1846. American author of Norwegian descent; translator of Heimskringla and of Björnson's works; prof. Univ. Wisconsin 1873–84; minister to Denmark 1885–89. *Norse Mythology*, 1875.

Anderson, ROBERT, U.S.A., 1805–1871. In charge of Ft. Moultrie, near Charleston, 1861. He moved to Ft. Sumter, which he was compelled to surrender, and retired from active service 1863.

Anderson, RUFUS, D.D., LL.D., 1796–1880. Sec. A. B. C. F. M. 1832–66; historian of various missions.

Anderson, WILLIAM, D.C.L., b. 1835. Leading British authority on war material; director-general of ordnance factories.

Andersonville. Military prison of the Confederacy, in Sumter Co., Ga., infamous by reason of the treatment of the prisoners confined in it. Out of about 50,000 nearly 13,000 perished from disease or from the inhuman discipline. At the close of the war Henry Wirz, a Swiss, to whom most of the barbarities were due, was tried, convicted, and hanged. The place where the soldiers had been rudely buried was transformed into a cemetery.

Andersson, NILS JOHAN, b. 1821. Prof. of Botany, Stockholm. *Salices boreali-amer.*, 1858; *Monographia Salicum*, 1867.

Andes. Longest and most continuous chain of mountains on the globe and, next to the Himalayas, the highest. It extends along the entire w. border of S. America, leaving on the west but a narrow strip of lowland. It is narrow relatively to its length, ranging from 60 to 300 m. in breadth. The s. end is partially submerged, forming the fiord coast of s. Chili, and has a height of 6,000 to 8,000 ft. In n. Chili it consists of two parallel ranges, with passes at 11,000 to 13,000 ft., and peaks exceeding 20,000 ft. Among them is Aconcagua, perhaps the highest peak in America, 23,290 ft. In Peru and Bolivia the mountain mass becomes more complicated, with a high plateau of 10,000 to 13,000 ft., capped on either side by ranges whose peaks exceed 20,000 ft., and with numerous cross ranges, the whole having a breadth of 300 m. Further north the chain diminishes in altitude, until at the Isthmus of Panama it consists merely of low hills.

Andesite. Variety of feldspar, triclinic in crystallization; intermediate in composition between the calcium feldspar, anorthite, and the alkaline feldspars, orthoclase and albite. Associated with hornblende, it is an important ingredient in much of the crystalline rock of the western cordilleras of N. and S. America.

Andocides, 467–391 B.C. Attic orator, included among the famous ten. Several of his orations are extant.

Andorra. Republic between France and Spain, semi-independent. Area 175 sq. m. Pop. 6,800, of Catalonian stock.

Andover Theological Seminary. Oldest Congregational divinity school in America, founded 1807 as a department of Phillips Academy, Andover, Mass.; controlled by Phillips trustees and a board of three visitors. It has 9 professors, ab. 60 students, a library of 50,000 vols., and a Palestinian museum.

Andradite. $Ca_3Fe_2Si_3O_{12}$. Calcium-iron garnet, occurring in a variety of colors; named for the Portuguese mineralogist d'Andrada.

Andrássy, JULIUS, COUNT, 1823–1890. Hungarian revolutionist 1848; prime minister 1867; Austrian foreign minister 1871–79.

André, JOHN, 1751–1780. B. in London of Swiss parentage; came to America 1774 in a British regiment. Appointed to negotiate with Arnold, he was intercepted on his return and executed Oct. 2, 1780, as a spy. His remains were taken to England 1821 and interred in Westminster Abbey.

Andrece, JAKOB, D.D., 1528–1590. Lutheran theologian; chancellor Univ. Tübingen from 1562; chief author of the *Form of Concord*, 1577.—His grandson, JOHANN VALENTIN, D.D., 1586–1654, court preacher at Stuttgart from 1639, was a prolific writer.

Andreæceæ. Small family of mosses of a single genus, *Andreæa*, natives of cold regions.

Andreæa rupestris.

Andree, KARL THEODOR, 1808–1875. German author and journalist; consul to Chili 1858. *Buenos Ayres*, 1856; *Geography of Commerce*, 1863–69.

Andrés, JUAN, 1740–1817. Italian Jesuit of Spanish birth. He wrote a history of literature in 7 vols., 1782–99.

Andrew, ST. Apostle, brother of Simon Peter; said to have been crucified at Patræ in Achaia.

Andrew, ST., OF JERUSALEM, 660–732. Abp. of Crete 711. Greek hymnist, known by Dr. Neale's translations, 1863.

Andrew, JAMES OSGOOD, D.D., 1794–1871. Methodist bishop from 1832, prominent in forming the M. E. Ch. South, 1844.

Andrew, JOHN ALBION, LL.D., 1818–1867. Gov. of Mass. 1860–66; the day following Pres. Lincoln's call for troops he had three regiments on the way. The prominent part taken by Mass. in the Civil War was due largely to his influence.

Andrew, SAINT, ORDER OF. (1) Founded in Scotland under James V., revived 1687 and 1703; also called Order of the Thistle. (2) In Russia, founded by Peter the Great 1698.

Andrewes, LANCELOT, D.D., 1555–1626. Bp. of Chichester 1605, Ely 1609, and Winchester 1619; first on the list of King James's Bible translators 1607–11, and a leading theologian; best remembered by his *Private Devotions*.

Andrews, CHARLES, LL.D., b. 1827. Associate Judge N. Y. Court of Appeals 1870; Chief Judge 1881.

Andrews, EDWARD GAYER, D.D., LL.D., b. 1825. Methodist bp. 1872.

Andrews, ELISHA BENJAMIN, D.D., LL D., b. 1844. Pres. Brown Univ. 1889. *Institutes of History*, 1887-89; *Economics*, 1889.

Andrews, HENRY C., 1799–1828. English botanist. *Botanist's Repository*, 1797–1804; *Heaths*, 1802–30; *The Heathery*, 1804; *Geraniums*, 1804; *Roses*, 1805–28.

Andrews, THOMAS, LL.D., 1813–1885. Prof. of Chemistry, Belfast, 1845-79. He made important investigations upon the continuity of the gaseous and liquid states of matter, and on ozone.

Androdiœcious. Plants with both perfect and staminate flowers, borne on different individuals.

Andrœcium. Stamens of a flower.

Androgynous. Flower-clusters which contain both staminate and pistillate flowers.

Andromache. Daughter of Ëëtion and wife of Hector of Troy; celebrated by Homer and Euripides.

Andromeda. Daughter of Cepheus; exposed to a sea-monster and rescued by Perseus by aid of the Gorgon's head. After death she was made a constellation of the northern heavens. Its center is near 0h. 30m. right ascension and 40° declination.—In botany, a genus of the Heath Family.

Andromonœcious. Plants which have both staminate and hermaphrodite flowers on the same individual.

Andron. In ancient Greek house the front portion, which was set apart for the men, the Gunaikeion or women's quarters being in the rear, separated from this, and entrance permitted to near male relatives alone.

Andronicus, LIVIUS, d. ab. 221 B.C. First Roman poet; a Greek from Tarentum, who came to Rome as a slave, was freed, and translated Greek plays into Latin. His first play, performed 240 B.C., was the beginning of Latin literature. He also translated Homer's *Odyssey* into Saturnian verse and wrote hymns. Only fragments remain.

Androphore. Tube formed by the filaments of monadelphous stamens, as in the Mallow Family.

Andros, SIR EDMUND, 1637–1714. Gov. of New York 1674–82; and of New England 1686–89. In 1687 he demanded the surrender of the Conn. charter, which was hidden in the "Charter-oak." On the news of the deposition of King James, the Bostonians seized and imprisoned him. He was gov. of Va. 1692–98, and of Guernsey 1704–06.

Androspores. Peculiar zoospores developed in the cells of certain green algæ.

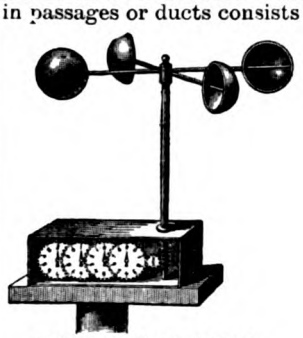
Androtion, 4th cent. B.C.; Athenian orator, contemporary with Demosthenes.

Anelectric. Any conductor of electricity; correlative to dielectric, a non-conductor.

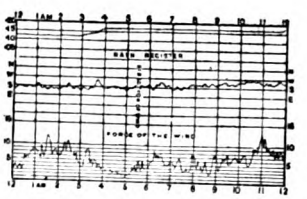
Anelectrotonus. Condition of a nerve in the ultropolar region, close to the positive pole of the exciting circuit. See ELECTROTONUS.

Anemograph. Instrument for recording changes in the intensity or direction of the wind. See ANEMOMETER.

Anemometer. Instrument for measuring the velocity of wind, or of currents of air in ventilating systems. For the former, in meteorological observations, the usual apparatus consists of cup-shaped vessels on the ends of arms which turn a central vertical shaft. The anemometer for currents of air in passages or ducts consists of a propeller wheel with a number of vanes or blades. The number of turns in any given time is recorded upon a series of dials, as the wheel is turned by the action of the air-current upon the inclined blades. The Wollaston anemometer measures the force of a chimney draft or other flue-current by recording the difference in pressure inside the flue and in the ordinary air.



Robinson's Hemispherical-cup Anemometer.



Register-sheet of an Osler's Anemometer.

Anemone. Genus of *Ranunculaceæ*, containing many species, natives of colder climates. It includes a number of early spring flowers, and some which are cultivated for ornament. In Zoölogy, SEA ANEMONES (q.v.).

Wood Anemone (*A. nemorosa*).

Anemophilous. Flowers cross-fertilized by the wind, which carries the pollen of one to the stigmas of another, as in the Pines and Oaks.

Anemoscope. Apparatus for showing or estimating the direction from which the wind is blowing; a wind-vane.

Anemosis. Condition of wind-shaken timber, the annual layers of wood parting from each other, supposed to be caused by violent gales, but perhaps due to other causes.

Anenterata. Group of animals in which there is no digestive tract, as in the *Cestodes*, *Mezozoa*, *Rotifers*, and *Acanthocephala*.

Anerio, FELICE, ab. 1560. Classical master of the Roman school, the last official composer of the Papal Choir. He wrote numerous masses, motets, madrigals, psalms, etc.

Aneroid. Portable form of barometer, consisting of a hollow elastic metallic box, with a corrugated top partially exhausted of air. Any variation in the external pressure produces a corresponding compression or dilatation of this box. A multiplying arrangement of levers causes an index to manifest, by its position on the face of a dial, the amount of this pressure variation. Careful preliminary graduation by comparison with a standard barometer enables the absolute pressure corresponding to each indication of the instrument to be recorded. It is not as accurate as the mercurial barometer.

Aneroid Barometer.

Aneurism. Dilatation of an artery, due to disease or in-

jury of its coats, a condition usually of slow development, which may occur in any of the arteries of the body, and whose danger varies according to the ease with which it may be operated upon. Those of the more deeply-seated vessels, or of those which supply large tracts of the body usually prove fatal. They are of frequent occurrence in the smaller arteries of the brain (miliary aneurisms) of the aged, and by shutting off the blood-supply from small areas of the brain cause slight paralysis of motion or sensation. When near the surface they give rise to soft compressible and pulsatile tumors, but when deeply seated they can, as a rule, be diagnosed only by a peculiar purring sound. Unless relieved, death results from the bursting of the sack.

Angeiology. Branch of anatomy which treats of the blood vascular system.

Angeioma. Tumor consisting of enlarged vessels; *e.g.*, a birth mark.

Angela Merici, 1511–1540. Franciscan nun who visited Jerusalem and founded at Brescia, 1537, the order of St. Ursula, to tend the poor and sick and teach the young.

Angelic Acid. C_4H_7COOH. Unsaturated monobasic acid found in the angelica root. White solid, combining easily with bromine.

Angelica. Plant of the *Umbelliferæ*. *A. Archangelica*, native of Europe. The leaf-stalks are candied, especially by the French, and known as Angelique. Name also applied to other species of the genus.

Angelica-tree. Small, spiny tree, *Aralia spinosa*, native of e. America; also known as Hercules Club.

Angelico. *Ligusticum Canadense*. Plant of the Carrot Family, native of the s. Alleganies; known also as Nondo.

Angelico, Fra Giovanni. See Fiesole.

Angelin, Nils Peter, 1805–1876. Swedish palæontologist, whose work established the existence in that country of Silurian strata. Known also by his monograph on the Silurian Crustacea of Scandinavia.

Angelo. See Michelangelo.

Angels. Sinless and glorified spirits, enjoying the immediate presence of God, and serving His purposes in creation and redemption. Satan, as the great antagonist of God, has also his angels, whom he is regarded as having drawn away with himself from original purity. Some, as Swedenborg and Rothe, teach that all angels were originally men, on some planet.

Angels of the Churches. In Rev. i.–iii.; identified with the churches, as if responsible; explained variously as abstract ideas, guardian spirits, colleges of presbyters, or bishops.

Angelus Silesius. Pen-name of Johann Scheffler, M.D., 1624–1677; German R. C. poet and mystic. Some of his hymns are familiar in English renderings.

Anger. Emotion aroused by injury or threat of injury; similar to resentment, but less settled, being the sudden instinctive outburst of passion.

Angers. City of France, on the Maine, near its junction with the Loire. Pop., 1891, 72,669.

Anghiera, Pietro Martire d', 1455–1526. Spanish priest of Italian birth, prior of Granada 1505. He left a Latin book on America, *De Rebus Oceanicis*, 1530.

Angina Pectoris. Neuralgia of the heart. A chronic fatal disease, in which paroxysms of severe pain occur, accompanied by a sense of suffocation. During the intervals, which may last a few hours or several months, the general health is usually good. It attacks men more often than women, is frequently inherited, may alternate with various nervous disorders, and usually occurs in advanced life, except when caused by excessive smoking.

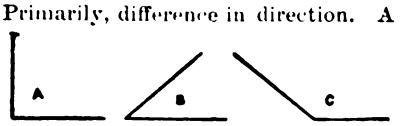
Angiospermæ. Class of *Spermatophyta* or flowering plants, having the ovules contained in a closed ovary, and including the greatest number of living species.

Angiospermia. Order of the Linnæan class *Didynamia*, including many plants of the Snap-dragon family, bearing their seeds in capsules or pods.

Angiosporous. Spores inclosed in a sac or membrane.

Angiostomata. See Opoterodonta.

Angle. Primarily, difference in direction. A plane angle



A, right angle; B, acute angle; C, obtuse angle.

is the measure of the amount of revolution about a fixed point which a straight line makes from a fixed initial line to reach a certain position. The position reached is called, in reference to the angle, its terminal line, the fixed point is the vertex of the angle.

Angle between Curves. Angle between the tangents to these curves at this point of meeting, taken in the plane determined by the tangents.

Angle Block. Cast-iron block of triangular section against which abut the struts or wooden braces in a Howe truss bridge.

Angle Iron. Wrought iron or steel bars rolled in an L-shape. The largest size in the market is 6x6 inches and 7-16 in. thick, weighing about 51 lbs. per yard. They are used in the construction of beams and columns for bridges and buildings. A steel angle 12x12 and one inch thick was rolled 1894 by the Bethlehem Iron Co., Pa.

Angle Leaf. Ornament, in the form of a leaf, often introduced in mediæval architecture to fill out the space between the circular or polygonal base of a column and the corner of the square plinth underneath.

Angle of Capillarity. See Angle of Contact.

Angle of Contact. Formed by the surface of a liquid with that of any body with which it comes in contact. See Capillarity.

Angle of Deviation. Angle which a ray of light on emerging from a refracting medium forms with its direction on entering. See Prism.

Angle of Friction. Included between a normal to a plane surface and the direction of the resultant force which causes a body to slide upon it; angle with the horizontal to which a surface must be inclined in order that a body may slide down it. Its tangent is the same as the coefficient of friction.

Angle of Incidence. Made by an incident ray of light with the normal to a reflecting or refracting surface at the point of incidence. See Reflection.

Angle of Reflection. Made by a reflected ray of light with the normal to the reflecting surface at the point of reflection. See Reflection.

Angle of Repose. Inclination of the surface of a bank of sand or earth in a condition of permanency. It lies between 30 and 40 degrees, varying with the kind of earth and the degree of moisture. It is frequently expressed by the ratio of its horizontal vertical projection; thus a slope of 1 to 1 is the same as an angle of 45°; a slope of 1½ to 1 corresponds to an angle of ab. 34°. The coefficient of friction of earth upon earth is found by dividing unity by this ratio.

Anglesa, or Anglesea. Island of n. Wales, the ancient Mona. Pop., 1891, 50,079.

Anglesite. $PbSO_4$. Lead sulphate, sometimes found in sufficient abundance to be mined as an ore of lead.

Angli. German tribe on w. bank of Elbe, who entered Britain with the Saxons and gave their name to England.

Anglian Dialects. See Anglo-Saxon.

Anglican Communion. Aggregate of those Episcopal churches which accept the Elizabethan model, the Ch. of England being central.

Angling. See Fishing.

Anglo-Saxon. Often called Old English. It extends roughly from A.D. 450–1100, and in space covers the area of Germanic conquest in Great Britain, excluding the Celtic population. It is a Low German dialect, nearest allied to the Frisian, and was brought to Britain by piratical settlers from the lower Elbe and the Cimbrian peninsula (Schleswig-Holstein). Its dialects are the Northumbrian (Humber to Forth), Mercian (southward to Thames), West-Saxon (south of Thames), and Kentish (in Kent and possibly Surrey). The Angles of the continent brought the Northumbrian and Mercian dialects, which are often grouped as Anglian, and furnished eventually the names England and English. The Saxons (as in names like Essex, Wessex) brought their dialect, except Kentish, which is due to the Jutes. Anglo-Saxon words are recorded from 679; but the earliest literature was Northumbrian, mainly preserved, however, in later West-Saxon copies. The language was inflected, had fairly abundant forms of declension and conjugation, and was rough, strong, and somewhat unwieldy. It forms to-day the bone and sinew of the English Language (q.v.).

Anglo-Saxons. Mixed population resulting from union of various Low German tribes which invaded England in 5th century.

Anglo-Saxon Chronicle. Record of events in English history to 1154.

Anglo-Saxon Literature. Produced by those writers who employed the inflected Teutonic language, from which, after the Norman French had enriched its vocabulary and

leveled its inflectional system, modern English sprang. Most manuals of English Literature discuss it under the title of "Old English," which ended with 1100 and was followed by a transitional period occupying the following century.

Little remains from heathen times, or from the period before 449, when the Angles and Saxons crossed from the continent to England. When Augustine came to introduce Christianity among them, in 596, a desire to cultivate a literature arose. The runes and tablets of beech were abandoned for the letters and writing materials used in Europe.

The kingdom of Wessex and that of Northumbria were the principal centers of literary development. In the former the great monasteries of Winchester, Malmesbury, and Glastonbury were seats of learning. St. Aldhelm (d. 709) is claimed to have written a poem *Andreas*. Cynewulf (perhaps of the 8th century) wrote *Crist*, a religious poem on the Incarnation; *Elene*, which told the story of the discovery of the true Cross at Jerusalem by the empress Helena; and *Juliana*, a biography of a saint. *Beowulf*, an epic upon a Swedish hero, is the most important of Anglo-Saxon remains. Formerly dated variously from the 5th to the 11th century, it is now generally assigned to the 8th. King Alfred translated into Anglo-Saxon Beda's *Ch. History*, Orosius's *Universal History*, and works of Pope Gregory and Boethius.

Northumbria produced Adannan and Caedmon, whose *Paraphrase of Bible History* is extant. The venerable Beda (d. 735) was a famous scholar and composed many works, prose and verse, in Latin; and Alcuin, who followed him by half a century, was summoned by Charlemagne to his court and died there 804. Like Beda, he wrote in Latin. The *Durham Gospels*, in an Angle dialect, and the *Homilies* of Aelfric, Abp. of Canterbury (d. 1006), are the last Saxon works of importance.

In the transition or Semi-Saxon period the most celebrated works remaining are the *Ormulum*, the *Brut* of Layamon, and the *Ancren Riwle*.

Angola. Portuguese W. Africa, s. and w. of Congo Free State; area ab. 600,000 sq. m.

Angora. City of Asia Minor, the ancient ANCYRA. Pop. ab. 30,000. Here Bajazet I. was defeated and made prisoner

Angora Cat (*Felis maniculata domestica angorensis*).

by Tamerlane, July 28, 1402, and his army practically annihilated. It was regained by the Turks 1415. The region is noted for its cats and goats, which have fine long and lustrous hair.

Angostura Bark. *Galipea cusparia*. Bark of a tall tree of the Rue Family, native of n. Brazil and Venezuela; used as a febrifuge.

Angot, ALFRED. b. ab. 1850. Assistant in Central Meteorological Bureau of France; author of annual volume of climatological statistics.

Angoulême. City of France, on left bank of the Charente. Pop., 1891, 36,960.

Angström, ANDERS JONAS. 1814–1874. Swedish physicist, prof. Upsala 1858. He made investigations in heat, magnetism, and especially in optics, and supplemented Kirchhoff's work on the solar spectrum. *Spectre solaire*, 1869; *Spectres des Gas simples*, 1871; *Temperature de la Terre*, 1871.

Anguillidæ. Small free-living thread-worms. Some are parasitic on plants, as in mildewed wheat grains. They grow with the sprouting wheat and pass into its ear, becoming sexually mature when the ear is ripe; finally the entire interior of the wheat-grain becomes filled with their eggs. To this group also belong the familiar "Vinegar Eels."

Angular Velocity. Space passed over in a unit of time by a point on a rotating body at a unit's distance from the axis of rotation. It is equal to $2\pi \times$ number of turns in one second of time. [π=3.1416] The linear velocity of any point at a distance R from the axis=R X angular velocity.

Angus, JOSEPH. D.D., b. 1816. Pres. Regent's Park (Baptist) College, London, from 1849. *Bible Handbook*, 1854; *Handbook of English Literature*, 1865.

Anhalt. Ancient German principality. It became independent in 13th cent., and was often divided among branches of the reigning family, and is now a state of the German empire. Area 906 sq. m.; pop., 1890, 271,759.

Anharmonic Ratio. If a straight line be cut in four points their anharmonic ratio is the product of the extreme segments divided by the product of the mean segment and that included between the extreme points. If four lines meet in a common point their anharmonic ratio is the product of the sines of the extreme angles divided by the product of the sine of the mean angle into that of the angle bounded by the extreme lines. If in either case this ratio equals unity it is called "harmonic."

Anhydrides. Chemical compounds obtained from certain acids by the removal of water. $H_2SO_4—H_2O=SO_3$, sulphuric anhydride. They form acids with water and salts with bases or oxides. Two main classes are known in organic chemistry; those formed from acids, as acetic anhydride and succinic anhydride and those formed from phenols, as the phtaleines.

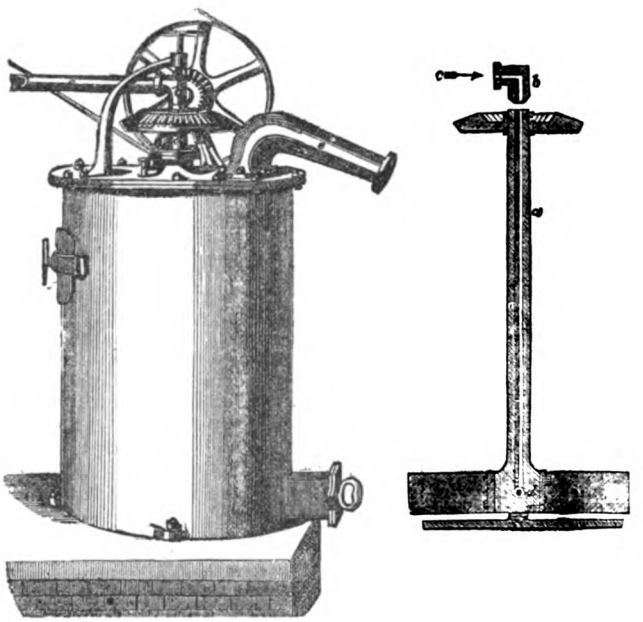
Anhydrite. $CaSO_4$. Anhydrous calcium sulphate, frequently found associated with deposits of rock salt.

Anhydro-bases. Compounds conceived to be formed by the abstraction of water from the anilides of the ortho-diamido compounds; obtained by the reduction of the ortho-nitro- anilides.

Anicetus. Bp. of Rome ab. 155–167; friend and host of the martyr Polycarp.

Anilide. Compound formed from aniline by substitution of an oxygenated acid radical for the hydrogen of the amido group in aniline. Thus acetanilide is $C_6H_5.NH.CH_3CO$. See ACETANILIDE.

Aniline. $C_6H_5NH_2$. Bpt. 185°C. Phenylamine. First obtained by Unverdorben in 1826 in distillation of indigo, and occurs in small quantities in coal tar and bone oil. It is a liquid of basic character derived from benzene by substituting the NH_2 group for one hydrogen atom. Made in large quantities, for use in the manufacture of the aniline colors, by treating nitrobenzene with iron-borings and hydrochloric acid



Cylinder for making Aniline.

which effects the reaction by hydrogen. The reaction taking place is: $C_6H_5NO_2+3H_2=C_6H_5.NH_2+2H_2O$.

Aniline Black. Nigraniline. $C_{30}H_{22}N_5.2HCl$. It is produced upon the fiber by a solution in water of aniline hydrochloride, potassium chlorate, copper sulphocyanide, and ammonium chloride. After dyeing the goods are run through an alkaline bath. Ammonium vanadate is substituted for the copper salt.

Aniline Blue. Triphenyl rosaniline hydrochloride, $C_{20}H_{19}(C_6H_5)_3N_3.HCl$. First made by Girard and de Laire 1861. Opal or cotton blue, soluble in alcohol, not soluble in water. Now made by heating rosaniline, aniline and benzoic acid in iron still until the desired shade is produced. It is then cooled somewhat, run into methyl alcohol, brought to boiling, one fourth part hydrochloric acid added, and run to crystallizing tank.

Aniline Brown. Bismark Brown, Triamidoazobenzene, $NH_2C_6H_4N_2C_6H_3(NH_2)_2$. Dinitrobenzene is reduced to metaphenylene-diamine by iron and hydrochloric acid, the iron salts decomposed by milk of lime and filtered out. By the action of nitrous acid upon metaphenylene-diamine the coloring matter is produced.

Aniline Colors. Properly, artificial dye-stuffs prepared from aniline and its derivatives. More broadly, all coal tar colors.

Aniline Green. Malachite Green $3(C_{23}H_{25}N_2Cl).\ 2ZnCl_2+2H_2O$. Made by treating 1 part benzoic anhydride with 2 parts dimethylaniline and 1½ parts zinc chloride, and oxidizing with lead peroxide.

Aniline Hydrochloride. $C_6H_5NH_2.HCl$. White crystalline substance prepared by the neutralization of aniline with hydrochloric acid. Easily soluble in water. The aniline can be recovered by the addition of an alkali to the solution of the salt.

Aniline Oil. Commercial aniline, various qualities consisting of aniline, aniline and toluidine, or toluidine with some impurities.

Aniline Red. Magenta $C_{20}H_{20}N_3Cl$. Obtained by Hofmann 1843. Made by the action of arsenic oxide upon a mixture of aniline and toluidine. $2(C_6H_7N)+4(C_7H_9N)+3As_2O_5=2(C_{20}H_{19}N_3.)+3As_2O_3+6H_2O$.

Aniline Yellow. Amidoazobenzene, $C_6H_5N_2C_6H_4NH_2$. Disc. by Mène 1861. Made by treating aniline and anilinehydrochloride with potassium nitrite.

Animal. All natural things have been recognized as belonging to one of three kingdoms, the Mineral, Vegetable, or Animal. A little study has shown us that there is a profound distinction between living and inanimate things, that plants and animals are essentially governed by similar laws in their growth and being, and that the substance (living matter or protoplasm) which composes the active part of their structure is, as far as our physical and chemical tests go, incapable of distinction. In defining an animal as distinguished from a plant, we must take a general survey of many features, and each statement will require qualification by exceptions. Animals ultimately depend for food upon the materials manufactured by the aid of chlorophyl, which is almost the exclusive property of a large part of the vegetable kingdom. Animals also as a rule actively seek their food, and are hence gifted with more acute sensation and have locomotor organs, a nervous system, sense, and digestive organs. Many of the lower animals (sponges, hydroids, sea lilies, etc.) resemble vegetables so far in external features as to deceive all but the scientific observer. There are about half a million species of animals, of which about half are insects. See BIOLOGY, PROTOPLASM, ANIMAL KINGDOM.

Animal Charcoal (BONE BLACK). The decolorizing power of this material was first observed by Lowitz in 1800. In 1812, Derosne introduced it for decolorizing sugars. It is made by charring the bones of cattle in retorts, after extracting the fat with a solvent; ammonia and bone oil are products of the distillation and are condensed in scrubbers of coke. The yield is 65 per cent charcoal, 10 per cent fat, 5 per cent bone oil, and 10 per cent ammonia as sulphate. The charcoal consists of carbon 10.51, calcium and magnesium phosphates, fluoride, etc., 80.21, calcium carbonate 8.30. A pound of charcoal will decolorize as much raw sugar.

Animal Chemistry. See PHYSIOLOGICAL CHEMISTRY.

Animal Magnetism. See HYPNOTISM.

Animal Worship. An expression of religious sentiment, which is found among nearly all races and peoples, and which is part of the widely extended belief among primitive man that everything in nature had a soul. The chief deities of many religions are represented in the form of animals, notably in ancient Egypt and among the early and existing tribes of N. America. The bull, lion, serpent, eagle and tortoise are among the principal animals worshiped. The latter is regarded as the ancestor of the human race by many of the American tribes, a belief of which indications exist at the present day in China.

Animalcules. Animals too small to be seen by the naked eye, or at least so small as to appear like specks. The entire subkingdom of the *Protozoa* belongs here; also the simpler forms of *Cœlenterates*, *Vermes*, *Polyzoa*, *Crustacea*, and *Tunicata;* also the embryos of the marine animals that have free swimming larvæ as stages in their development. The term is a popular one, and has no meaning in classification.

Animalculists. Those who believed the germ which develops into the fœtus to be the spermatozoon, or at least to reside in it.

Animal Fluids. Normally found in the body and necessary for the digestion, absorption, and distribution of the food. They furnish vehicles for the removal of the waste of the body, and lubricate surfaces which are in contact with each other. The gastric juice, perspiration, and vaginal mucus are normally acid, the urine occasionally so; all the other fluids are alkaline. The gastric juice, saliva, secretions of the pancreas and intestines, bile, blood and lymph are concerned in the assimilation of the food; the urine and perspiration remove deleterious and waste products; the tears, mucus, and watery fluids found in the joints, abdomen and other cavities act as lubricants. The spermatic fluid and milk are usually included, and are alkaline.

Animal Heat. Developed by the processes which take place within a living body, the evolution of which ceases at death. In man it maintains the temperature of the body at ab. 98.5°.

Animal Kingdom. Divided into three great series, the *Protozoa*, *Mesozoa* and *Metazoa*. The last has these sub-kingdoms: *Porifera*, *Cœlentera*, *Vermes*, *Arthropoda*, *Molluscа*, *Molluscoida*, *Echinodermata*, *Tunicata* (eight groups known as Invertebrates), and *Vertebrata*. The Invertebrates are often considered by themselves, and divided into the *Acœlomata* and the *Cœlomata*. Some authors establish a group *Chordata*, including the Vertebrates and Tunicates. Cuvier, followed by Agassiz, recognized four types: the Radiates, Articulates, Molluscs and Vertebrates, but this division is more artificial than natural, and is now no longer retained. The group *Vermes* is composed of several phyla, each of which is separated from the others by as strong characters as divide most of the sub-kingdoms. All these groups were fully evolved when the earliest strata, which show organic remains, were laid down. As the previous strata are sometimes termed azoic, it simply means that they contain no fossils, not that at that period of geological history there existed no animals. The earliest ancestors of each sub-kingdom almost certainly possessed no firm skeleton, and they were besides of microscopic size. The subkingdoms, as is true of any group of Taxonomy, are not to be considered as following each other in a series, although it is possible to place them in such a sequence that the simplest or "lowest" forms stand first enumerated and the most complex or "highest" last. They were probably simultaneously evolved by simple phylogenetic differentiation, which principle operated at once on the earliest differentiated groups to produce further differentiation. In a certain sense all animals are equally old, but doubtless swimming forms preceded land forms, and flying animals were last evolved.

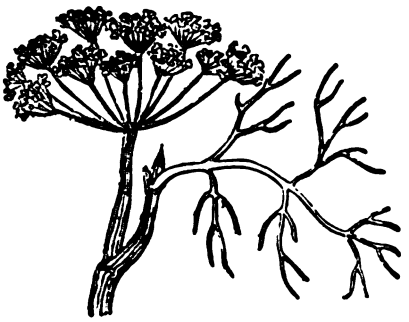
Animal Pole (FORMATIVE POLE). That pole of eggs with considerable yolk, where the most protoplasm is gathered and the nucleus also, and where segmentation takes place with greatest rapidity to form the micromeres of the segmenting ovum. When the yolk is excessive, as in the eggs of birds, reptiles and some fishes, the formation of the large segments (macromeres) apparently drops out, so that the micromeres remain as a germinal disc, which spreads from the animal pole, surrounding the entire yolk and closing at the vegetative pole, sometimes elsewhere, to form a sort of "blastopore."

Animal Strength. A horse working 10 hours per day can exert a traction of 100 lbs. at a speed of 2½ miles per hour, on a tow-path, or whin, or circular power. For a short time he can exert an effort sufficient to do the 33,000 ft. lbs. per minute called for by the nominal horse-power of steam engines. A man, pushing or pulling on a level, will do about ⅛ as much as a horse in a working day of 10 hours; but at a crank of derrick or winch, or in pumping, where he depends mostly on the arms, a man will do about 1-10th of a horse-power of work.

Animism. The conception that matter has a life or soul, a belief common to primitive people who regard all things having motion, and even many destitute of power of motion in themselves, as having life. They frequently considered all things that man made, his tools and weapons, as endowed with life and often an extension of his own personality. Remarkable illustrations of this are found among the American Indian tribes, who ceremonially give life to their daily instruments, nourish and feed them, and ceremonially kill them at the death of their owner. The grotesque objects we designate as idols are expression of the sentiment, and all charms and amulets, many of which are carried even by intelligent people at the present day, are survivals of this primitive idea.

Anion. Constituent of an electrolyte which goes to the anode. See ELECTRODE.

Anise Hyssop. *Vleckia Fœniculum.* Herb of the Mint Family, native of the western States.



Anise-seed.

Anise-seed. *Pimpinella Anisum.* Plant of the Carrot Family, native of s. Europe, cultivated for its aromatic fruit.

Anise Star. *Illicium anisatum.* Shrub of the Magnolia Family, native of China, producing a highly aromatic star-shaped fruit.

Anisic Acid. $C_6H_4:(O.CH_3)COOH$. Methyl derivative of para-oxybenzoic acid. Beautiful rhombic prisms. Prepared from the dimethyl salt of para-oxybenzoic acid by saponification.

Anisobranchiata. See CTENOBRANCHIATA.

Anisodactylous. Arrangement of the toes of birds, in which three (out of four) are turned forward.

Anisol. $C_6H_5.O.CH_3$. Bpt. 153°C. Methyl-phenyl ether. The methyl salt of phenol or carbolic acid. Liquid of agreeable odor, formed by the action of methyl iodide upon sodium phenate.

Anisol Red. Anisolazo-β-naphtholdisulphonic acid. $CH_3O.C_6H_4.N_2.C_{10}H_4(HSO_3)_2.OH$. Dye-stuff prepared by the action of diazoanisidine upon β-naphtholdisulphonic acid. Sodium salt is used.

Anisopleura. Section of *Gastropoda* having the gills belonging to one side more or less suppressed; or both gills may be absent, as in Heteropods, or placed externally, as in Nudibranches. There are two divisions, the *Streptoneura* and *Enthyneura.* These animals may be conceived as having had their dorsal portion rotated so as to stretch the original left side around to the right, thus pushing the right-side organs onto the left. The anus is thus brought forward to the neck, and the intestine forms a loop. The original left-side organs are usually aborted, *i.e.*, not present on the new right side.

Anisopoda. See ISOPODA.

Anisopola. See HOMOSTAURA.

Anjou. Ancient French province, including the present department of Maine-et-Loire. Godfrey, its count in 12th century, was ancestor of the Plantagenets, and it belonged to kings of England 1154–1204. From Count Charles sprang kings of Naples, Sicily, and Hungary. A. became a fief of Naples, but returned to the French crown by inheritance 1328. In 1360 King John made his son Louis duke of A. Louis afterward became King of Naples. Louis XI. took A. from René II., last of that dynasty, reannexing it to France 1484. Since then A. has given honorary title to princes of the royal family.

Anker, MATHIAS JOSEPH, 1771–1843. Austrian mineralogist; associate and the successor of Mohs as prof. at Gratz. He wrote on the mineralogy of Styria.

Ankerite. Calcium-magnesium-iron carbonate resembling dolomite.

Ann, CAPE. On e. coast of Mass.

Anna. Prophetess who in the Temple joined Simeon in recognizing the infant Jesus.

Anna, ST. Supposed mother of the Virgin Mary. Her day in the Roman calendar is July 26.

Annabergite. $Ni_3As_2O_8+8aq$. Hydrous nickel arsenate. Rare mineral found in Saxony.

Anna Comnena, 1083–ab. 1150. Daughter of Alexius I. She married Nicephorus Bryennius, and conspired against her brother John, then emperor, who spared her life. At 60 she entered a convent and wrote a life of her father, 1069–1118.

Anna Ivanovna, b. 1693. Empress of Russia 1730–40. Her reign is noted for the atrocious tyranny of her creature Biren.

Annals. Favorite variety of historical composition among the Romans, in which events were briefly given, arranged under single years. The Pontifex Maximus wrote the *Annales Maximi,* and many authors also followed this plan.

Annam. See ANAM.

Annapolis. City and seaport, capital of Maryland; on the Severn, 2 m. from Chesapeake Bay. It contains the U.S. Naval Academy. Pop., 1890, 7,604.

Annapolis, NOVA SCOTIA. Oldest European settlement n. of Gulf of Mexico except Santa Fé and St. Augustine; founded by the French 1604, as Port Royal; unsuccessfully attacked by Mass. 1707. On the conquest of Acadia by the English, 1710, its name was changed to A. in honor of Queen Anne. It was the capital till superseded by Halifax 1750. Pop. ab. 2,800.

Ann Arbor. City of Mich., on Huron R., capital of Washtenaw Co., seat of State univ. Pop., 1890, 9,431.

Annas. Father-in-law of Caiaphas, Jewish High Priest, and associated with him in the condemnation of our Lord. Himself formerly High Priest, he saw five sons High Priests after him, and enjoyed an influence so great that Renan holds him mainly responsible for the death of Christ.

Annatto. *Bixa Orellana.* Small tree of the natural order *Bixineæ,* native of tropical America, but widely diffused through warm regions by cultivation. The seed pulp yields the commercial article.

Anne, 1665–1714. Queen of England 1702; second daughter of James II.; married 1683 to Prince George of Denmark. Her reign was celebrated for literary activity.

Anne of Austria, 1602–1666. Daughter of Philip II. of Spain; married 1615 to Louis XIII. of France; regent 1643.

Anne of Brittany, 1476–1514. Heir of Francis II., Duke of Brittany. Married to Charles VIII. of France, Dec. 1491, and to Louis XII. Jan. 1499.

Anne of Cleves, 1515–1557. 4th queen of Henry VIII. of England; married Jan. 6, 1540, and divorced July 9, 1540.

Anne of Denmark, 1574–1612. Wife of James I. of England 1589.

Annealing. Operation of heating, followed by retarded cooling, by which steel and glass are rendered less brittle. It has been found in steel that local heating in the process of fabrication causes molecular strains in the structure of the piece; also that severe mechanical treatment, such as punching and shearing, has a tendency to send the carbon into the combined state with the metal at the affected edges. The heating and slow cooling dissipate the local strains from the first set of causes, restore the softness, and lower the elastic limit, which have been effected by the second causes. An annealed structural piece is not under initial strain before being placed to withstand a proportion of working strain in service.

Annelida (ANNULATA). Articulated worms, having a brain, circum-œsophageal nerve ring, a ventral nerve chain, a vascular system and often setæ, or processes for locomotion. Many are hermaphrodite, and some multiply asexually by transverse division, the segments having retained a measure of individuality. They form the sub-classes *Chætopoda, Gephyrea,* and *Hirudinea.*

Nereis pelagica.

Annihilationism. Doctrine that those who remain impenitent will cease to exist, either at death, or at the last judgment.

Anning, MARY, 1799–1847. Native of Lyme Regis, England, who contributed in no small degree to our knowledge of the great Enalio-Saurians and other forms of organic life entombed in that vicinity. She developed the remains of many fine Ichthyosauri and Plesiosauri, which, without her care, would never have been presented to comparative anatomists in a form for study.

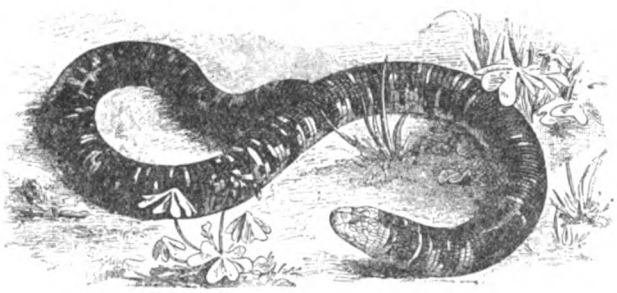
Annuity. Yearly sum of money granted by one party to another in fee, for life or for years, charging the personal estate of the grantor. If the grant is a burden imposed upon land it is a rent charge. The value to accrue or in arrears may be reckoned at simple or compound interest, giving the elements of an arithmetical or a geometrical progression. Problems in annuities are solved by the laws of these series.

Annular Eclipse. Central eclipse of the sun when the bodies are so situated that the apparent diameter of the sun exceeds that of the moon, thus showing a ring or annulus of light around the limb of the moon.

Annular Wheel. Operating by inside gear, in which the centers of the driving and driven wheel are both on the same side of the point of contact, both wheels turning in the same direction. There is less obliquity when the number of teeth differ widely with a given arc of contact than in the case of outside gear.

Annulata. Sub-order of lizards, with snake-like body, hard scaleless skin divided into rings crossed by longitudinal furrows. The sternum is absent, and so usually are extremities, though small front feet may be present. Eyelids are absent. They are

mostly American and live, like the *Cœcilians*, underground, generally in ant-hills. The tongue is short and thick. *Amphisbæna* is an example. See ANNELIDA.



Amphisbæna fuliginosa.

Annuloida. Group including *Echinoderms* and the *Scolecida*.

Annulosa. Group of bilateral and segmented Invertebrates, including the *Scolecida*, *Anarthropoda*, and *Arthropoda*.

Annulus. Elastic ring of thick-walled cells which embraces the sporange in certain ferns, and by parting, causes its rupture at maturity, thus expelling the spores. Also, a layer of cells around the operculum of a moss sporange. Also, the portion of the volva of a mushroom remaining attached to the stalk.

Annulus Piscatorius. Papal signet-ring, with the effigy of St. Peter fishing; first assumed at the Pope's coronation.

Annunciation, FEAST OF THE. March 25, commemorating the visit of Gabriel to the Virgin Mary, to announce the coming birth of the Saviour.

Anode. Positive terminal of any electric generator. In any other electric device it is the point at which the current enters it.

Anodon (ANODONTA). See UNIONIDÆ.

Anodyne. Medicine to relieve pain; opium preparations, haschish, chloroform, ether, etc.

Anogens. See BRYOPHYTA.

Anointing. Perfusion with olive oil; a festal usage much followed in warm Eastern climates; transferred into symbolism of the descent of Divine graces at the inauguration, in Israel, of kings and priests. The names Christ and Messiah signify The Anointed One.

Anomaly. In meteorology, amount by which a given observed quantity is greater or less than a value that is assumed as an ideal or theoretical normal value. See DEPARTURE.

Anomaly, ECCENTRIC. The orbit of a planet or comet being an ellipse, let a circle be described having its major axis for a diameter; from the place of the planet draw a line perpendicular to this axis and joining with the center of the circle the point where this perpendicular intersects the circle. The angle between this line and the major axis is the eccentric anomaly.

Anomaly, MEAN. Angular distance at which a planet or comet would be from its perihelion if it had moved uniformly with its mean or average velocity.

Anomaly, TRUE. Angle between two lines drawn respectively from the center of the sun to the place of a planet or comet and to the perihelion of its orbit.

Anonaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 61 genera and ab. 400 species, distributed throughout Asia, Africa, tropical and subtropical America, and N. America; commonly called the Custard-Apple Family.

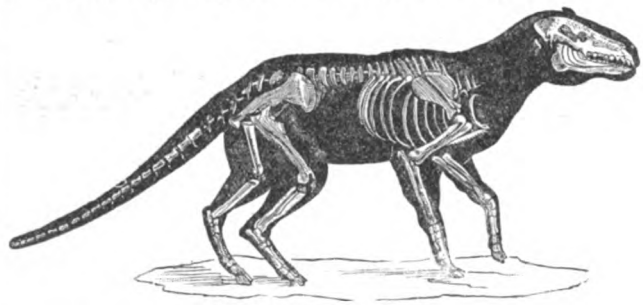
Anomodontia. The *Dicynodontia* in a broad sense, including also *Rhynchocephalia* and *Theriodontia*.

Anomoura. Group of Decapod crustacea, with characters intermediate between those of *Macrura* and of the *Brachyura; e.g.*, the Hermit Crabs. The abdomen is partly rudimentary, some of the appendages are absent, others are modified to help hold the body in the helicoid shell of some gasteropod mollusc, which the animal inhabits and carries about with him. When the shell becomes too small, a new house is sought.

Anopla. See NEMERTEA.

Anoplotheridæ. Family of bunodont, even-toed Ungulates, comprising fossil forms from the Eocene and Miocene. There is no diastema in the jaw. The group is a connecting link between the Swine and Ruminants.

Anoplotherium. Fossil pachydermatous quadruped, described from the Paris tertiaries by Cuvier; about the size of a fallow deer, with two-toed feet, rudiments of two other digits, a slender body, and a long, strong tail. This fossil may be said to mark the beginning of vertebrate palæontology.



Anoplotherium commune.

Anoplura. Order of Ametabolic insects, including *Pediculus* (the louse). This is parasitic, with mouth parts formed for suction, and the eyes are simple ocelli only. One species (*P. tabescentium*) causes the disease known as Phthiriasis. This group is ordinarily included with the *Mallophaga*, as *Aptera* or *Parasitica* under the group *Rhynchoti* (*Hemiptera*), of which these forms are regarded as degenerated types.

Anorthite. $CaAl_2Si_2O_8$. Variety of feldspar, triclinic in crystallization, containing calcium as the characteristic basic element.

Anselm, 1033–1109. Scholastic philosopher and theologian. Abbot at Bec in Normandy 1078; Abp. of Canterbury 1093. In his contests with William Rufus and Henry I. he showed great firmness in defending the claims of the Church. He is considered the ablest of the Schoolmen who tried to base theological dogmas on reason.

Anseres. Linnæan order of natatorial birds, including those having webbed feet, as in the Duck, or lobed feet, as in the Grebe. Families: *Alcidæ*, *Anatidæ*, *Colymbidæ*, *Laridæ*, *Pelecanidæ*, and *Procellaridæ*. In a restricted sense, only the Ducks and Geese. See LAMELLIROSTRES and ANATIDÆ.

Anserinæ (GEESE). Sub-family of *Anatidæ*, distinguished from Ducks chiefly by having stronger and longer legs set further forward, comparatively shorter wings, and shorter and deeper bill, with much smaller *lamellæ*. *Anser* includes Land Geese, and *Branta*, the Sea Geese. Of these *B. bernicla* is the BARNACLE GOOSE (q.v.). A number of genera of so-called Geese do not belong to the *Anatidæ*, though nearly related. Of these are: the Cape Barren Goose of Australia, now domesticated, distinguished by having a large green cere which reaches nearly to the tip of the bill; the Semipalmated Goose, also of Australia, with rudimentary webs; the Spur-winged Goose of Africa, the Egyptian Goose, and the Orinoco Goose. They represent the genera *Cereopsis*, *Anseranas*, *Plectropterus*, and *Alopochen*.

Anser Goose (*Anser ferus*).

Ansgar, ST., ab. 800–865. Apostle of Scandinavia; b. in Picardy. He labored in Denmark and Sweden 826–831; Bp. of Hamburg 831, and of Bremen 846, these being headquarters for his evangelizing work in the north.

Anson, LORD GEORGE, 1697–1762. English naval officer and explorer. He circumnavigated the globe 1742–44, defeated a French fleet 1747, and was first Lord of the Admiralty 1751–56.

Ansonia. Manufacturing town of New Haven Co., Conn. Pop., 1890, 10,342.

Ansted, DAVID THOMAS, F.R.S., 1814–1880. English geologist, prof. King's Coll., London, 1840; author of several popular books.

Anster, JOHN, LL.D., 1798–1867. Prof. Univ. Dublin; tr. *Faust*, 1835.

Anstey, CHRISTOPHER. 1724–1805. English poetical humorist. *New Bath Guide*, 1766.

Anstey, F. Pen-name of THOMAS A. GUTHRIE (q.v.).

Anstice, JOSEPH, 1808–1836. English hymnist.

Answer. Response of a witness to a question in a judicial proceeding; also pleading interposed by defendant in equity to the bill, or in admiralty or divorce to the libel, or under the reformed procedure to the complaint.

Ant. See FORMICIDÆ.

Antacids. Broadly speaking, alkalies, but, as most commonly employed, members of that group used to correct undue acidity of the stomach, the ones usually used being the carbonates of magnesium, sodium and potassium.

Antæ. In classic architecture, piers formed by prolongation of side-walls of a temple and flanking the columns of the portico. A portico is said to be *in antes* when the lateral supports of the pediment are piers and not columns.

Antæus. Giant, invincible while on the ground. Hercules discovered his secret, lifted him into the air, and killed him.

Antagonistic Drugs. Those which have directly opposite effects upon the system and which counteract the effects of each other; *e.g.*, opium and belladonna, or acids and alkalies.

Antagonistic Muscles. Those which pull in opposite directions and thus maintain the equilibrium of an organ or part; *e.g.*, the muscles of the abdomen and back, which sustain the trunk in an erect position.

Antagoras. Ab. 270 B.C. Rhodian, author of the *Thebais*, an epic, and epigrams, of which a few still remain.

Antalcidas, PEACE OF, 387 B.C. It transferred the Greek cities in Asia to the Persian king.

Antananarivo. Capital of Madagascar. Pop. ab. 50,000.

Antara, or ANTAR, ab. 550. Arabian poet, who wrote one of the *Moallakat*, poems suspended in the Kaaba at Mecca. He occupies a great place in the romantic literature of Arabia. His biography, containing some of his verses, comprises some 50 MS. vols., but a condensed form of it has been tr.

Antarctic Continent. Land within and near the Antarctic Circle, known as Enderby, Sabrina Adelie, and Victoria Lands, and the S. Shetland, S. Orkney, and S. Georgia islands. The coast has been little explored, and practically nothing is known of the interior.

Antarctic, or SOUTHERN, **Ocean.** Water s. of the Atlantic, Pacific, and Indian oceans. Area ab. 7,900,000 sq. m. Sir James Ross penetrated to 79° S. lat., and discovered, Jan. 1841, Mt. Erebus, a volcano 12,400 ft. high.

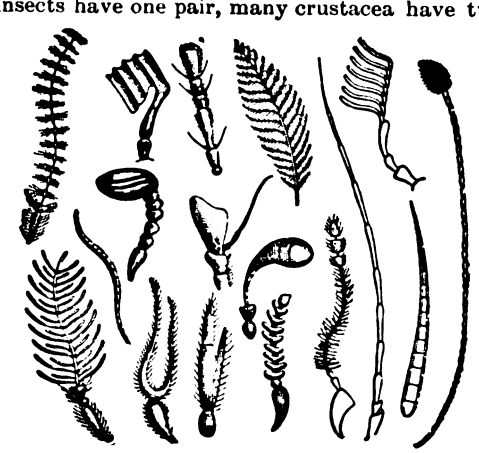
Antares-*a* SCORPII. First magnitude star. Right ascension, 16 h. 22 m. 36 s. Declination, 26° 11′ 6″.

Ant-eater. See VERMILINGUIA (Edentata).

Antefixæ. Upright stones, or tiles with decorated faces, placed above the cornice upon the flank of a classic building, originally intended to cover the joints of the roof-tiles. Also, ornaments affixed to the frieze of an entablature.

Antelopes. See ANTILOPIDÆ.

Antennæ. Slender jointed feelers on the head of anthropods. Insects have one pair, many crustacea have two pairs,



Various Forms of Antennæ of Insects.

as in the Crabs. They are organs of touch, hearing, smell, and orientation, or the equilibrium sense. They are beset with hairs of various sorts that serve to convey a variety of vibrations, or impressions, to the nerves. Special ear sacs are present in the basal joint of the antennules in Crabs. It has been observed that some insects (ants) use them in communication, hence they may be organs of language. The antennæ and antennules of *Crustacea* are primarily post-oral appendages that have been shoved in front of the mouth; those of insects are procephalic horns and never exceed one pair in number. They are therefore not homologous with those of *Crustacea*.

Antennary Gland. Of Crustacea. See GREEN GLAND.

Antenor. Trojan elder, who advised the restoration of Helen to Menelaus, and was spared by the Greeks on the capture of Troy.

Anterior Abdominal Vein (EPIGASTRIC VEIN). Along the middle of the abdominal wall in Amphibians and Reptiles; present in the embryos of birds and mammals as the allantoic vein. It receives a part of the blood that comes back from the hind limbs and carries it to the portal veins in the liver. The remaining blood from the hinder part of the body passes partly into the post cava and partly into the renal-portal system to the post cardinals.

Anteros. Divinity who avenges unrequited love; sometimes a god who opposes Eros.

Anthelion. Bright spot on opposite side of the observer from the sun as seen in complete halos; due to the reflection of the sun from a large number of small parallel surfaces.

Anthemion. Ornament derived from the honeysuckle, introduced in the necking of columns and piers of the Ionic order.

Anther. Sacs borne by the filament of the stamen, containing the pollen.

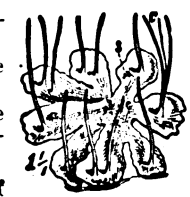
Antherid. Male organ of reproduction of ferns, club-mosses, horsetails, true mosses, liverworts, etc. Minute sac, containing a greater or smaller number of antherozoids.

Antherozoid. Minute masses of protoplasm contained in the antherids of ferns, mosses, etc. They are the male elements of reproduction of these plants, and are endowed with a rapid spontaneous spiral motion by means of vibrating cilia.

Anthesis. Period of flowering of plants.

Anthobranchiata. See PYGOBRANCHIA.

Anthocerotæ. Small family of Liverworts of terrestrial habit.



Anthoceros lævis.

Anthocyanin. Coloring matter of blue flowers.

Anthodium. Compound flower of the natural family *Compositæ*, as that of the Sunflower, Chrysanthemum and Daisy.

Antholeucin. Coloring matter of white flowers, dissolved in the cell sap.

Antholite. Fossil raceme bearing a fruit termed *Cardiocarpon*.

Anthology. Collection of lyrics and epigrams, usually Greek, Latin, or Oriental.

Antholysis. Retrograde metamorphosis of a flower, as the reversion of stamens to petals, or sepals to leaves; a not uncommon condition in certain plants.

Anthomedusæ. See TUBULARIÆ.

Anthon, CHARLES, LL. D., 1797–1867. Prof. of Classics in Columbia Coll. from 1829. He pub. various editions of Greek and Latin authors, his *Horace*, 1830, being the best known.

Anthony, ST., ab. 251–356. Egyptian, Father of Christian monasticism. He became an anchorite early in life, and was consistent in his asceticism and avoidance of society; but many followed him into the desert, seeking instruction, and ab. 305 he established a monastery near Fayoum. He was a friend of Athanasius and of orthodoxy, and was greatly revered.

Anthony of Padua, ST., 1195–1231. B. in Portugal; famous Franciscan preacher; patron saint of the lower animals; canonized 1232. His day is June 13.

Anthony, SUSAN BROWNELL. b. 1820. Advocate in the U.S. of anti-slavery, temperance, and woman's rights.

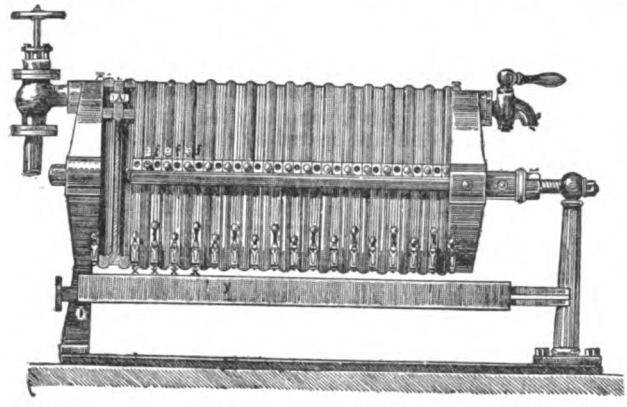
Anthophyta. Sub-kingdom of plants, comprising all those that produce true flowers, having stamens and pistils, and are reproduced by means of seeds; known also as *Phænogamia*, *Phanerogamia*, and *Spermatophyta*; commonly called the Flowering Plants.

Anthoxanthine. Coloring matter of yellow flowers.

Anthozoa, or ACTINOZOA. (Coral polyps.) *Cœlenterates* with an œsophagus which opens at the lower end into the gastrovascular cavity and is united to the body wall by radiating mesenteries. They usually secrete a solid calcareous skeleton, which has the form of a cup, with radiating, vertical septa,

corresponding in position with the mesenteric spaces. They are divided into the *Rugosa*, *Alcyonaria*, and *Zoantharia*.

Anthracene. $C_{14}H_{10}$. Mpt. 213°C. Important solid hydrocarbon, formed by the action of heat upon coal, and obtained from coal-tar. It contains two benzene rings of 6 atoms of carbon linked by two CH groups. Mainly used in the manufacture of artificial alizarine. Oxidizing agents change it to anthraquinone.

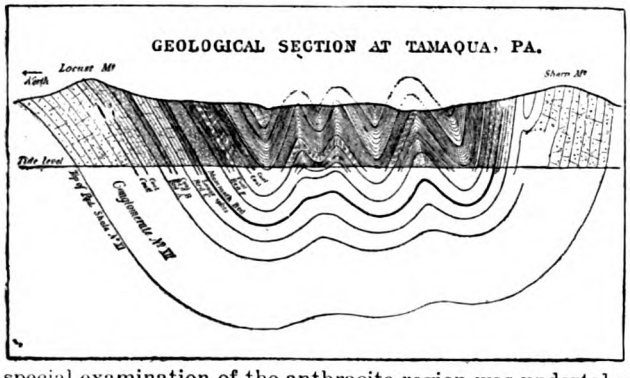


Danek's Filter Press.

Anthracene Colors. Artificial dye-stuffs derived from anthracene, anthrapurpurin, flavopurpurin and isopurpurin, reds; nitroalizarin, orange; gallein, violet; cœrulein, green, and alizarin brown.

Anthracene Oil. Semi-liquid distillate, boiling from 300° to 400° C., obtained from coal tar; called also *green grease*. It contains large quantities of anthracene, which is obtained from the oil by pressing, or by the use of the centrifugal machine. It contains numerous liquid hydrocarbons.

Anthracite. Called in England culm, or stone coal. The term applied to the harder, firmer, heavier kinds of mineral coal, those which contain the most carbon, and in which the percentages of hydrogen and oxygen are relatively low. See COAL, for relation between anthracite and bituminous coals. It is found in s. Wales and England, in R. I., Va., Col. (Gunnison Co.), and N. M., though in none of these in any great abundance. The great anthracite producing region of the world is comprised within an area of 470 sq. m. in 8 counties of e. Pa. The thickness of the coal measures, the number and character of the beds, vary from place to place; in the Panther Creek basin, *e.g.*, 21 beds with a total thickness of 126 ft. are contained in 2,300 ft. of measures; near Pottsville the measures are 3,300 ft. thick and contain 28 beds, aggregating 154 ft. in thickness. At one point the Mammoth vein is 114 ft. thick. In 1893 the mines yielded 53,810,214 tons of 2,000 lbs., valued on the spot at $93,091,670; Col. and N. M. produced 93,000 tons: and from 1820 to 1892 the total shipments were ab. 885,000,000 long tons of 2,240 lbs. The Pa. Coal Waste Commission estimates the amount still remaining, and obtainable by present methods of mining, as 6,880,000,000 long tons, a supply which, with only a moderate increase of output over the present, would be exhausted in less than 100 years. In 1880



a special examination of the anthracite region was undertaken by the Second Geological Survey of Pa.; the reports comprise several vols. of text, with atlases. The same survey has also pub. a valuable work on the methods followed in mining.

Anthraconite. $CaCO_3$. (1) Black marble colored by carbonaceous matter; (2) Limestone which, when struck with a hammer, gives off a strong bituminous odor.

Anthracosis. Discoloration of the lung tissue, observed in those exposed to inhalation of coal dust.

Anthramine. $C_{14}H_{11}N$. Amido compound derived from the hydrocarbon anthracene.

Anthranilic Acid. See AMIDOBENZOIC ACIDS.

Anthrapurpurin. $C_{14}H_5O_2 : (OH)_3$. Trioxyanthraquinone. Prepared by the action of potassium chlorate and sodium hydrate upon the anthraquinonesulphonic acids. It is one of the main constituents of the red shades of alizarine found in trade.

Anthraquinone. $C_{14}H_8O_2$. Mpt. 277° C. White solid produced by the oxidation of anthracene. Chromic acid is used technically as the oxidizing agent. Used for the manufacture of artificial alizarine.

Anthraquinone-sulphonic Acid. $C_{14}H_7O_2.SO_2.OH$. Monobasic acid formed by the action of sulphuric acid upon anthraquinone. The disulphonic acids, $C_{14}H_6O_2:(SO_2.OH)_2$, are similarly formed. Used in the manufacture of artificial alizarine.

Anthrax. (1) Contagious and very fatal disease of the domesticated animals, one form or another of which is probably the murrain mentioned in Exodus. In certain parts of the world it prevails to such an extent that the bodies of the animals dead of it constitute a serious menace to public health. Its most prominent symptoms are a high fever and the formation of carbuncular swellings which in a short time, often not more than two hours, cause mortification of the tissues in their vicinity, and speedy death if enough of them exist. In some cases death occurs before the carbuncles have time to develop. It is an inoculable disease, communicable to man, and caused by the bacillus anthracis. Inoculations of cultures of this bacillus are an absolute protection against the disease, and since its discovery by Pasteur its ravages have been greatly lessened. (2) The same disease in man, contracted by contact with diseased animals, or by handling the wool, hides, tallow, etc., from them. What is known as carbuncle is sometimes termed anthrax.

Anthrol. $C_{14}H_9.OH$. Phenol or hydroxyl derivative obtained from anthracene; known in various isomeric forms: prepared from anthracene-sulphonic acid and potassium hydroxide.

Anthropidæ. Sub-order of Primates, including the old order *Bimana*. It includes one family, *Hominidæ*, and one genus, *Homo* (Man), which possibly comprises only one species. The zoölogical characters of man distinguishing him from the other primates are erect posture, bipedal progression, the hinder limbs being used for the sole purpose of supporting the body. The foot has a broad sole, distinct heel and non-opposable hallux, which is the largest of the pedal digits. The hands are used for prehension, and the thumb is not only opposable, but is capable of abduction or adduction. The spine has a double curve, and the skull is supported at near its center below. There is no sagittal crest, and the superciliary ridges are small. There is a well-marked chin. The canines are small, and no diastema is present. The capacity of the cranium is never less than 40, and may be 100 cubic inches; the brain weighs from 45 to 60 ounces, and it is more abundantly convoluted than in any other mammal. The body is nearly or quite naked, and requires special artificial protection in colder regions. Man is psychologically very different from other animals in having religious systems, developing sciences and arts, and in using a language of sounds and symbols to express rational thought. For the Races, see MAN.

Anthropogeny. Science of the evolution of man. See Hæckel's works.

Anthropoid Apes. See ANTHROPOMORPHA.

Anthropology. Natural history of Man. This science includes the following great departments: (1) Human Biology, or Anatomy and Physiology. (2) Ethnology, the science of the relationship and origin of the races of man. (3) Archæology, which treats of the development of arts and civilization, as based on studies of prehistoric remains as well as of literary monuments. (4) Comparative Philology, as especially useful in its aid to Ethnology. (5) Sociology, which treats of institutions, customs, beliefs, cults, and Political Economy in its broader historic relations. Other terms refer to special departments, viz., Anthropogeny, the science of the origin or evolution of man; Craniometry, or more inclusively, Anthropometry, which compares measurements of the head and different parts of the body of different races; Criminology, which treats of the characteristics and causes of abnormal human beings (Psychological Teratology); Penology, the science of Prison Discipline; Neurology; Psychiatry, etc. No other science so combines all sciences as that which treats of this, our microcosm; and nowhere is a classification of sciences more powerfully suggested, or more difficult in application. Its founders may be said to be Blumenbach and Prichard; the latter pub. his ethnological and philological works 1813–43. The complexity of this science compels a systematic treatment

rather than a chronologic one. On the question of Man's place in the zoölogical series we have the anatomical researches of Owen, Huxley, and Mivart. The consensus of zoölogical opinion seems to uphold Linnæus's classification, that Man is a primate included with Apes in one group; but he, with Mivart, Wallace, the Duke of Argyll, etc., considers that the real man is a rational spirit, united to the animal nature, which alone is treated by Biology. Darwin's position on the question of the origin of Man (in which he agrees in conclusion with Lamarck, while differing in modus operandi of the evolution) is that he has been developed from anthropoid apes. On this subject Agassiz held the view that Man had several independent origins, and was developed from numerous germs, each of which was specially created in the various regions of the earth that are the natural homes of the races. Other polygenists are Pouchet and R. S. Poole. Quatrefages and modern evolutionists are essentially monogenists, thus superficially agreeing with Prichard and the theologians. On the classification of the races of Man, Blumenbach is responsible for the division into five races commonly known; but this is so faulty that Prichard found it needful to distinguish eleven races. Huxley's classification is the best, for it recognizes the Australians as distinct, and distinguishes the blond from the brunette type of whites. The discovery (1830–50) of rough flints in caves and alluvial deposits, underlying strata containing polished flints, these again succeeded by bronze and iron implements, while the latest strata contained coins and historically datable remains, suggested a higher antiquity for Man than was commonly believed; and it is now certain that Man was contemporaneous with the retreat of the ice fields, of the Glacial Period in Europe, 20,000 to 80,000 years ago. These facts have been investigated by Prestwich, Tylor, Lubbock, Lyell, etc., while Lepsius, Brugsch, Bunsen, etc., have determined the approximate dates of ancient Egyptian dynasties to be 4000 B.C.; but these were preceded by mythic, prehistoric eras, during which the civilization was evolved. The origin of Man is thus lost in the haze of geological antiquity, for it seems highly unlikely that glacial man is the primitive man. His appearance in extended numbers in the Quaternary Period suggests his evolution in the Tertiary. In w. N. America are found Tertiary remains of man. There are facts in the distribution of some of the Polynesians that suggest the existence of a vast continent to the south of the Indian Ocean, upon which lived primitive savages of a low type of development. But questions of this sort are of secondary interest to physiological, sociological, psychological, and pedagogical investigations, which to-day are engaging the efforts of anthropologists. To the names above cited must be added Carl Vogt, Broca, Retzius, Waitz, Quetelet, Fritsch, Forschhammer, Steenstrup, Sir John Davis, Rawlinson, Mantegazza, representing all departments of Anthropology. For the relationship of the races and tribes, see articles INDIANS, ALGONQUINS, APPALACHIANS, AZTECS, AUSTRALIANS, etc.

Anthropometry. Measurements of the different dimensions of the body and of its parts, and their comparison with similar ones in others, throw considerable light upon the history and development of man, and are also of practical importance, it having been learned that the ratio between them is never the same in two persons, thus furnishing a method of identification especially applicable to criminals. Also by their means standards of proper physical development are made which show at a glance the particular shortcomings of any person subjected to them and the particular form of exercise necessary to raise him to the average may be determined.

Anthropomorpha. Group of Catarhine monkeys including the most man-like of the apes, characterized by absence of tail and cheek pouches and generally also of ischial callosities. The fore-limbs are longer than the hind limbs, and a semi-erect posture is assumed in progression on the ground. A vermiform appendix is present. the lower outer incisors are larger than the central ones, the reverse of this obtaining in the upper jaw. The sternum is broad as in man, hence the term "Latisternal Apes." The thumb is never rudimentary and is always opposable to the other digits. The hallux is much like the pollex. The spine has a single curve. There are three genera with four species, the first two Oriental and the last two African; viz., *Hylobates* (Gibbons),

Chimpanzee (*Troglodytes niger*).

Orang-outang (*Simia satyrus*).

Simia, or *Pithecus* (Orang-outang), and *Troglodytes* (Chimpanzee and Gorilla).

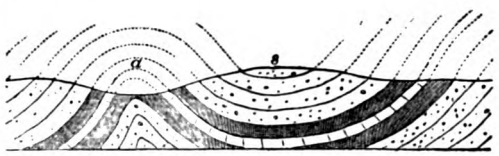
Anthropomorphism. Idea of Deity which conceives of his powers, or form, or both, as analogous to the human. All Greek gods, *e.g.*, are anthropomorphic.

Antias, Q. VALERIUS, 1st century B.C. Roman historian, much quoted by Livy, who considered him unreliable.

Antichlor. Used to neutralize chlorine; usually sodium hyposulphite.

Antichrist. Expected from apostolic ages, as embodying and heading the last great effort on earth to supersede the Gospel, destined to be crushed by the Coming of the Lord. The term occurs but four times in Scripture, and only in St. John's Epistles.

Anticlinal Axis. Line from which the strata dip at two different angles.



a, Anticline; *s*, Syncline.

Anticlinal Vertebræ. Eleventh dorsal of rodents and allied mammals. The spines of the other vertebræ, both anterior and posterior, point toward it.

Anticosti. Island in Gulf of St. Lawrence. Area ab. 2,600 sq. m. Its colonization, 1873, was a failure.

Anticyclone. (Term introduced into meteorology by Francis Galton 1863.) A general horizontal movement of the atmosphere in which the wind blows spirally around and away from a central region of high pressure and clear weather. Observations show that in the n. hemisphere the rotation is clockwise; in the s. hemisphere it is counter-clockwise. Also applied to motions of the same type in any fluid. Anticyclones are usually, but not necessarily, composed of cold or heavy clear dry air relative to the air in cyclones. The best illustration of these movements is afforded by the outflow of air from the continents in the winter season.

Antidote. Anything administered to counteract the effect of a deleterious or poisonous substance introduced into human beings or animals; as ferric hydroxide for arsenious oxide, or atropine for morphine.

Antietam, Md., BATTLE OF. Sept. 16–17, 1862, ending in Lee's withdrawal. Union loss 12,500; Confederate loss over 10,000.

Antifebrine. See ACETANILIDE.

Antifunction. Base from which the function arises, expressed in terms of the function. The symbol is usually "—1" placed to the right and above the abbreviation expressing the function. $\phi = \tan^{-1} x$ is read ϕ is the arc whose tangent is x. Some use the word expressing the base prefixed to that of the function, as $\phi =$ arc. tan. x, read as above.

Antigone. Daughter of Œdipus by his mother Jocaste. She accompanied her sightless father into exile, buried her brother Polynices in defiance of Creon the king, and was immured in a cave, where she killed herself.

Antigonus, ab. 381–301 B.C. One of Alexander's officers and successors, King of Asia 306.—His grandson, A. GONATAS, ab. 320–243 B.C. was King of Macedon 277, as was his nephew A. DOSON, 229–221 B.C. Another A., ab. 80–36 B.C., was King of the Jews and executed by Mark Antony.

Antilles. W. India islands, the Bahamas excepted. There are 3 groups: the Greater A., comprising Cuba, Haiti, Jamaica, and Porto Rico, and the small islands near them, with an area of 83,635 sq. m., and a pop. of 4,342,000; the Virgin Islands, area 268 sq. m., pop. 39,000; and the Lesser A., aggregating 4,359 sq. m., pop. ab. 1,000,000.

Antilogarithm. Number corresponding to any given logarithm. Its symbol is generally "—1", placed as an exponent above the abbreviation "log." If x=log.y; y=log.$^{-1}$x is read y is the quantity whose logarithm is x, or simply y equals antilog. x.

Antilogous Pole. That part of a pyroelectric body which shows negative electricity when the temperature is rising and positive electricity when it is falling. See ANALOGOUS POLE.

Antilopidæ. Family of Antelopes of the Cavicorn Ruminants. Most are African, are numerous in genera and species, and take the place of the true deer in that country, resembling deer in the general build of body; *e.g.*, the Springbok, goat-like in form and movement; the Gnu, with a body resembling that of a horse, but with forward-directed, hook-shaped horns; the Eland, or Cape Elk, with nearly straight backward-directed spiral horns; and the Gazelle, of n. Africa, with nearly upright horns and noted for the luster of its eyes. In Europe the family is represented by the Chamois. In India is the curious Chickara, the females of which are hornless, while the males have four horns. In N. America is the Prong-buck, the females of which have small horns, while the male has large

Antelope cervicapra.

horns with a prong in front above the extremity of the horn-core. The sheath is also shed annually, an exceptional thing in *Cavicornia*. Accessory hoofs are wanting. Antelopes differ from true Deer in having horns like those of cattle.

Antimachus, OF COLOPHON. Greek Epic and Elegiac poet of 5th century B.C.

Anti-masons. Party active in N.Y. and other States after the murder of Wm. Morgan, who was about to divulge masonic secrets 1826. It supported a national ticket 1832, and elected a governor of Pa. 1835.

Antimeres. Zones, with included organs, of Radiates, bounded by the interradii. The perradius passes through the center of each. See RADIAL SYMMETRY, ACTINOMERE and PLATYTROPE. The term also designates the opposite sides of a bi lateral organism, or of a ray.

Antimonates. Salts of antimonic acid, H_3SbO_4.

Antimonic Acid. H_3SbO_4. Formed by treating antimony pentachloride with water; very unstable. At an incipient red heat it decomposes, losing water and leaving antimony pentoxide as a residue.

Antimonic Chloride. $SbCl_5$. When chlorine in excess is passed over antimony, or antimony trichloride, the pentachloride is formed. It is a yellow liquid, decomposing at 140°.

Antimonic Sulphide, or ANTIMONY PENTASULPHIDE. Sb_2S_5. Formed by passing hydrogen sulphide into a solution of antimonic acid. When dry, it is a golden-yellow powder known as "sulphurauratum."

Antimonious Chloride, or ANTIMONY TRICHLORIDE. $SbCl_3$. Made by treating antimony with chlorine, or by dissolving antimony in hydrochloric acid with addition of nitric acid. It is a colorless soft substance, and is sometimes called "butter of antimony." It is used for browning gun barrels.

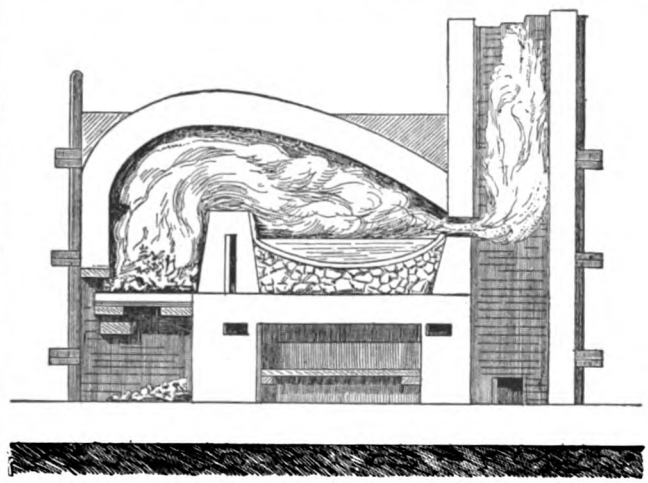
Antimonious Oxide, or ANTIMONY TRIOXIDE. Sb_2O_3. White powder, made by burning antimony in the air, or oxidizing it with nitric acid.

Antimonious Sulphide, or ANTIMONY TRISULPHIDE. Sb_2S_3. Made by passing sulphuretted hydrogen into a solution of antimony trichloride; thus precipitated, it is orange red. It occurs in nature as STIBNITE (q.v.).

Antimoniuretted Hydrogen, or STIBINE. SbH_3. Colorless, inodorous gas, made by treating tartar emetic with zinc and dilute sulphuric acid. It burns with a greenish-white flame, is unstable, and on breaking down leaves a deposit resembling that of arsine.

Antimony. Sb. At. wt. 120. Sp. gr. 6.7. Sp. ht. 0.05. Mpt. 430°C. Volatile at bright red heat. Occurs in metallic state and in combination with sulphur as stibnite and the metals, as ruby silver ore, gray copper ore, etc. Metal first extracted from its sulphide by Basil Valentine in 15th century. When heated to a dull redness, it ignites, forming the trioxide. It is soluble in aqua regia, hot concentrated sulphuric acid, and hydrochloric acid. It is oxidized by nitric acid to antimony trioxide or antimonic acid. It has acid and basic properties.

METALLURGY. The principal mineral is antimony glance or stibnite, the sesqui-sulphide, found in many localities, but no-



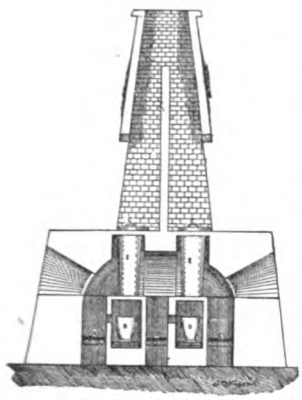
Antimony Roasting Furnace.

where in very large amounts. The Hungarian mines were once the largest producers; later, Australia and Borneo have furnished large amounts; at present France and Japan supply the largest quantities. In the U. S., the only important mines are in Nevada, producing 200 to 300 tons a year, the ore being smelted in San Francisco. The total annual production of the world is probably not over 2,000 tons, valued at $400,000. Price, Feb. 1895, 7¼–8¼ cts. per lb., according to quality.

Pure stibnite is a gray, lustrous, cleavable mineral, very easily fusible, and containing 72 per cent of antimony. When melted in the air the sulphur is easily oxidized, leaving the oxide, which is easily reducible by carbon. Or, if melted without access of air, but in contact with a reagent having a great

affinity for sulphur, the metal is liberated. These two properties of stibnite are the bases of the two following methods of reduction. By the iron reduction process the ore is first heated in clay cylinders having perforated bottoms, in which the pure stibnite is melted away from the rest of the ore and drained into crucibles below. This concentrated ore is then melted in crucibles with scrap-iron, preferably sheet-tin clippings. The iron takes the sulphur, forming iron sulphide, which floats as a slag upon the impure metal below. This is poured out, and the crude metal refined by remelting with sulphate of soda and other fluxes. By the roasting and reduction process the ore is first concentrated, either as just described, or by liquation on the sloping hearth of a furnace. The concentrated mineral is then roasted at a very gentle heat with free access of air on the hearth of a reverberatory furnace; the gray, roasted ore consists of the oxide, and is cooled, ground, mixed with charcoal dust and a little soda-ash, and reduced in crucibles. The crude metal thus produced must be afterward refined. The refined metal is cast into cakes about 9 in. sq. by 2 in. thick, showing beautiful feathery or star-like crystals on the upper surface, whence it is called star antimony.

Several patents have been taken out for extracting the metal from its ores by electricity. The principle involved in most of them is to dissolve the antimony sulphide from the ore in a solution of an alkaline sulphide (ammonium, potassium, or sodium sulphide), and then to electrolyze the solution, using insoluble anodes of carbon or platinum, and receiving the deposit on copper cathodes.



French Furnace for Liquating Antimony Sulphide.

Pure antimony has a white color, tarnishing slightly yellowish, is rather hard, but so extremely brittle that it can be powdered in a mortar. Its principal use is to harden other metals and alloys. Lead containing up to 20 per cent of antimony is known in commerce as hard lead, and is produced in large quantities as a by-product of the silver-refining works. Such an alloy is used as a cheap antifriction metal, as an acid-resisting metal for pumps and faucets, and for making cheap type-metal. The composition of the numerous alloys varies almost indefinitely, but the following figures show some typical ones: "Type-metal," 60 to 80 per cent lead, 15 to 20 per cent antimony, up to 20 per cent tin, up to 10 per cent copper. "Britannia metal," 90 per cent tin, 6 per cent antimony, 3 per cent copper. "Pewter," 60 to 80 per cent tin, 5 to 10 per cent antimony, 1 to 2 per cent copper, up to 3 per cent zinc, up to 35 per cent lead. "Babbitt metal" (anti-friction), 60 to 80 per cent tin, 10 to 15 per cent antimony, 5 to 10 per cent copper, up to 2 per cent aluminium. A soft bearing-metal is made of 45 per cent lead, 45 per cent zinc, 10 per cent antimony. Antimony is very deleterious to the working properties of some metals, a very small proportion of it destroying entirely the malleability of gold or copper.

Externally, its soluble salts cause an eruption somewhat similar to that of small-pox, and they have been used for that purpose by malingerers. Poisonous doses give rise to symptoms which resemble those of dysentery. Taken internally, the effects of metallic antimony and of its salts are essentially the same, causing nausea and vomiting, diarrhœa and a weak action of the heart, with marked depression of all the vital functions. Formerly it was extensively used, but it has been abandoned in favor of less dangerous remedies. The only salt much used is tartar emetic, antimony and potassium tartrate; but formerly the metal itself, either powdered or in the shape of cups which imparted its properties to fluids allowed to stand in them, was extensively employed. "Everlasting Pills" were metallic antimony.

Antimony Tetroxide. Sb_2O_4. White powder at ordinary temperatures; on heating it becomes yellow. It is formed by heating antimonic acid or antimony trioxide.

Antimony-Vermillion. Red powder, probably containing an oxysulphide of antimony; prepared by boiling six parts of sodium thiosulphate with five parts of antimony trichloride and fifty parts of water.

Antimonyl Salts. Derived from the hydroxide SbO.OH. Antimonyl sulphate has the formula $(SbO)_2SO_4$.

Antinode. Part of a vibrating body between the nodes; also called a ventral segment or loop. See NODE.

Antinomianism. Pernicious doctrine, found in various degrees of exaggeration, that Faith justifies without regard to the attitude of the heart and life toward the Moral Law.

Antinomy. Antagonism for two propositions or doctrines which seem separately to have conclusive proof for their truth, and which yet cannot both be true. It expresses the idea of contradiction, plus the feeling that the argument is strong for both terms of it.

Antinous, d. 122. Favorite of Hadrian, who had him enrolled among the gods.

Antinous.

Antioch. Ancient capital of Syria, on left bank of the Orontes ab. 20 m. from its mouth; founded 301 B.C. by Seleucus Nicator; believed to have had a pop. of 400,000; often visited by earthquakes, one of which in 526 is said to have destroyed 250,000 lives. In 5th century here the disciples were first called Christians. It became the seat of the 4th patriarchate, its bishops ranking with those of Alexandria and Rome. Several church councils met here. A. was taken by Persians 540, by Saracens ab. 638, regained by Eastern emperor 966, lost again 1086, retaken by Crusaders 1098, captured by sultan of Egypt 1269. The modern Antakia has a pop. of 12,000.

Also, a city of Pisidia, Asia Minor, visited by St. Paul, of which

Antioch.

extensive ruins still remain. Several other ancient towns had this name.

Antioch, SCHOOL OF. Second great exegetical school of ancient Christianity, carried off finally by one-sided rationality into Nestorianism, as Alexandria by one-sided mysticism into Monophysitism.

Antioch College. Founded at Yellow Springs, Ohio, 1852. It has 12 instructors, ab. 100 students of both sexes, and is supported by the Disciples.

Antiochus, ab. 423 B.C. Sicilian Greek historian, praised in antiquity. Only fragments are extant.

Antiochus. Name of 13 kings of Syria, of the Seleucid dynasty, reigning between 280 and 65 B.C.—A. THE GREAT, 223–187, maintained an unsuccessful war with Egypt, and another of 7 years, 212–205 with his revolted Asian provinces; conquered Palestine and Cœlo-Syria 198; was defeated by the Romans at Thermopylæ 191, and again at Mt. Sipylus 190; gained peace 188 by ceding everything e. of Mt. Taurus; killed in an attack upon a temple.—A. EPIPHANES, 175–164, fought Egypt successfully 171–168; by his attempt to root out the Jewish religion excited a revolt of the Jews under the Maccabees which he could not quell; died in a state of raving insanity, and was called *Epimanes* (madman) by his subjects.

Also 4 kings of Commagene, the first of whom aided Pompey 49 B.C., and the last of whom A.D. 38–72, helped the Romans against the Parthians and the Jews.

Antiodont Teeth. Molars with tubercles opposite each other on each tooth, as in the upper jaw of horse and in both jaws of Ruminants and most Perissodactyls. The lower jaw of *Equus* presents *amœbodent* molars. Cope distinguishes these types: *Selenodont*, *Tapirodont*, *Hyracodont*, *Trichechodont*.

Antipater, d. 319 B.C. Regent in Macedonia when Alexander crossed into Asia 334 B.C, After Alexander's death, 323,

he waged war on the Greeks and gained a great victory over them at Crannon 322. (2) Father of Herod the Great, procurator of Judæa 47–43 B.C. (3) Herod's eldest son by his first wife, executed for conspiracy against his father, 2 B.C.

Antipatharia, or SCLEROBASICA. Group of corals (*Zoantharia*) having only six tentacles; the polyps are supported upon a horny axis, which is secreted by the common bases and the cœnosarc of the colony.

Antipathy. Dislike or opposition arising from no definite or recognized cause, but existing independent of immediate volition. Etymologically, it is the opposite of sympathy, but in actual use does not hold that relation.

Antiphanes, ab. 370 B.C. Athenian comic poet, leader in the Middle Comedy. He wrote many plays, of which fragments exist.

Antiphon, ab. 480–411 B.C. Earliest of the ten great Attic orators. Seventeen of his orations are extant.

Antiphon. Verse of Scripture sung before and after the Canticles and Psalms of the Daily Office in R. C. Ch.

Antiphonal Singing. Responsive style practiced with psalms and anthems from earliest times, two choirs alternating with verses or half verses; obviously a relic of the Hebrew Temple worship.

Antipode. Opposite extremity of that diameter of the earth passing through a given point; also, an inhabitant of the other side of the earth whose feet are directly opposite to the feet of those on this side. The antipode of N. Y. is in the sea, s.w. of W. Australia.

Antipope. Illegitimate claimants of the Roman See, variously numbered by various authorities. The usual list includes 31, between 218 and 1449.

Antipyretics. Employed to reduce the temperature in fever. Quinine, aconite, antipyrine, phenacetin, acetanilid, and a number of other derivatives of coal tar are the medicines, and cold baths and spongings, the measures, most commonly used. As fever is a symptom rather than a disease, they are not curative; but they are of benefit in preventing excessive waste of the tissues, render the patient more comfortable, and enable him to digest food better.

Antipyrine. $C_{11}H_{12}N_2O$. Mpt. 113° C. Oxyphenyldimethylpyrazole. Compound prepared by action of methylacetacetic ether upon phenyl hydrazine. Thick colorless prisms, much used in pharmacy as a febrifuge.

Antique. Adjective coextensive with "ancient," but more especially applied to classic antiquity; hence used as a noun to signify some relic of the past, or, collectively, ancient classics, art and style.

Antiquity of Man. One of the most stoutly contested doctrines in geology. The traditional few thousand years assigned to man's existence became an article of belief to scientists and theologians alike. Isolated discoveries indicating a greater antiquity were ignored or impugned. But in spite of the opposition even of geologists, the facts continued to multiply. Schmerling at Liège and MacEnery at Torquay boldly asserted the contemporaneity of man with animals now extinct. But their words fell on deaf ears. Boucher de Perthes for nearly twenty years collected from the gravels at Abbeville irrefutable evidence of man's antiquity in the valley of the Somme. But, wrote Lyell, "the scientific world had no faith in his statements that works of art had been found in undisturbed beds of such antiquity with the bones of the mammoth and rhinoceros." It was not until Falconer, Prestwich, Lyell himself, Evans, Gaudry, and others, had visited the spot and seen the evidence for themselves, that they became convinced.

Since that time Pengelly's researches in Kent's Cavern have placed the doctrine beyond further question. Not only was man the companion of the mammoth, mastodon, Irish elk, and other post-glacial animals now extinct, but there is little room to doubt that his origin extends into preglacial times in the Old World and must be sought in the later Pliocene fauna. It is even thought by some that his most distant pithecoid ancestor worthy of the name of man may belong to a fauna as old as the early Pliocene. Of this however there is at present no direct evidence, while Man in the Miocene is certainly a scientific myth.

The deposits in Kent's Cavern consist of a black mould 3 to 12 in. thick, beneath which lies a granular stalagmite, sometimes 5 ft. thick, and below this a thin black band, chiefly charcoal, the "hearth of the old cave men," from which Pengelly took 366 flint and bone implements of different kinds. Four ft. of red cave earth follow with bones of the cave-lion, hyena, cave-bear, mammoth, woolly rhinoceros, and sabre-toothed tiger, with abundance of flints, flakes and hammers. 12 ft. of crystalline stalagmite underlie this, resting on a coarse breccia with remains of the cave-bear and lion and very massive rude flint tools. The caves on the banks of the Vézère, in France, corroborate the testimony of Kent's Cave. In them Christy and Lartet found similar implements and weapons, with figures of the mammoth and other extinct animals sculptured on ivory and stone.

Antiquity of Species. Phrase which has become current to express the fact that some species have existed on earth longer than others. According to the views that formerly prevailed, such a phrase would be meaningless, because all species were then believed to have come into existence at the same time.

Anti-renters. Party of 1843–47, formed by tenants of land in N. Y. State, who held their farms under a practically feudal system. Appeals to the courts proving useless, they organized for belligerent resistance to the landlords. Many of the leaders were imprisoned and order at length restored 1847 by the enactment of measures of relief.

Antisana. Volcanic peak of the Andes, in Equador. Ht. 19,137 ft.

Antiscorbutics. Substances used to cure or prevent scurvy. Lime juice, fresh vegetables and fruits are the most valuable and most commonly employed.

Antiseptics. Bodies which arrest or prevent putrefaction, especially those used in surgical practice and in the treatment of diseases caused by septic germs. Those most commonly employed are corrosive sublimate, carbolic acid, thymol, iodoform, iodol, naphthol, naphthalin, and a number of bodies similar to the last named, derived from coal-tar. See SURGERY and DISINFECTANTS.—In engineering, substances which have the property of preventing the decay of timber, as chloride of zinc, bichloride of mercury, and creosote oil. Solutions of these are injected under pressure into the timber, which becomes more or less saturated, and the albuminoid particles are surrounded by the antiseptic material, so that decomposition cannot arise.

Antisthenes, ab. 445–370 B.C. Athenian philosopher, founder of the Cynic School. He taught that men should be satisfied with little and be independent of external conditions, thus finding virtue and happiness. His followers carried these ideas to great extremes.

Antithesis. Rhetorical figure which opposes one fact or statement to another.

Antitoxin. Substance obtained from cultures of the bacillus of diphtheria in beef bouillon and then by inoculation in a horse. The serum of the horse's blood is used by inoculation in treating the disease, and as a preventive in those exposed to it; developed by Dr. Koch of Berlin and his pupils, Drs. Roux and Behring. Its true value has not yet been determined, but on theoretical grounds it should be great.

Antitrinitarianism. Common designation of all Christian systems denying that God exists in personal triplicity.

Anti-twilight. Equivalent to the German *Gegendämmerung*, used by Bezold 1864; bright arc a few degrees above the horizon and opposite the sun. Its brightness is due to the light reflected from the illuminated portion of the atmosphere.

Antlers. Horns of a deer. The frontal protuberance present the first year is a bosset; the second year it grows into a stem or snag; the third year one front branch appears (brow antler); another branch is added the fourth year (bes, or bay-antler); a large third branch appears above these the fifth year (antler royal); the sixth year the top becomes palmate, or has several prongs that grow into tines, seven at most; this is the antler surroyal, or crown antler. The main stem is the beam, the branches are tines.

Antlia, or ANTLIATA. See DIPTERA.

Antliæ. Spiral proboscis (spiritrompe) with which butterflies suck up the juices of flowers. Its parts are the homologues of the galeæ of the mouth of biting insects.

Ant-lion. See PLANIPENNIA.

Antocular Membrane. Layer of epidermis which covers the cornea of the eye of snakes. It is shed when the skin is cast, rendering the animal temporarily blind. It serves to protect the eye in the absence of lids.

Antonelli, GIACOMO, 1806–1876. Cardinal 1847; papal secretary of state 1850–70. He wielded immense influence during the pontificate of Pius IX. and acquired vast wealth. He became a deacon 1840, but was never a priest.

Antonello da Messina, ab. 1414–1493. Italian portrait painter, famed for the introduction of oil-painting into Italy. His rare pictures, in the National Gallery, Louvre, Antwerp and Berlin Museums show him an earnest and capable artist. He was led to study oil painting in Flanders by seeing a picture of Jan Van Eyck at Naples. His epoch-making significance began in Venice, where he settled 1473. Here Giovanni and Gentile Bellini came under his influence, and developed from it the greatest school of oil painting known to history, the Venetian art of the 16th century.

Antonine, WALL OF. Built 140; a rampart of earth and stone ab. 20 ft. high, parallel to a fosse ab. 20 ft. deep, reaching from the Frith of Clyde to the Frith of Forth; length ab. 36 m. There were 18 forts on the line, connected by a military road on the s., known as Graham's Dike by the natives.

Antonini Itinerarium. Record of the stations and distances along the different imperial roads of the Roman empire; originally from Julius Cæsar's survey, revised several times.

Antoninus Liberalis, ab. 147. Greek grammarian, from whom we have a collection of mythological tales of metamorphoses.

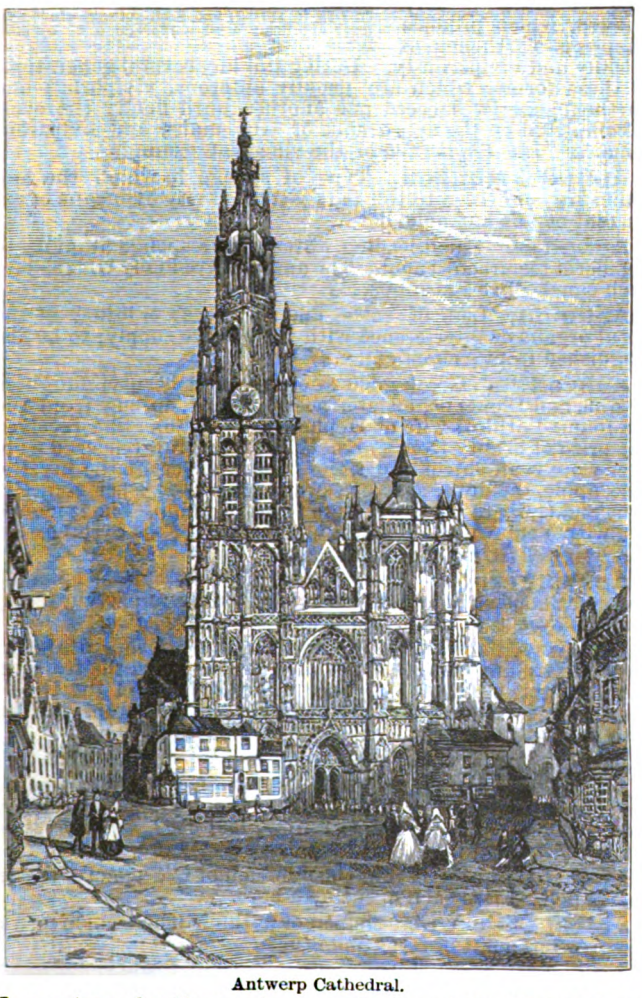
Antoninus, MARCUS. See AURELIUS.

Antoninus Pius, 86–161. 15th Roman emperor 138–161; noted for virtue. Rome was so happy as to have almost no history during his reign. He adopted M. Annius Verus M.) Aurelius) as his successor.

Antonius, MARCUS, 143–87 B.C. Roman orator, praised by Cicero, murdered by Marius; grandfather of Mark Antony.

Antony, MARK, 83–30 B.C. Son of Julia, sister of Cæsar; dissipated and profligate in youth, enemy of Cicero, and partisan of his uncle; consul 44 with Cæsar, whom he meant to succeed, but found a rival in Octavianus; formed with him and Lepidus 2d triumvirate 43; after battle of Philippi met Cleopatra and followed her to Egypt; invaded Parthia 36, Armenia 34, was crushed by Octavianus in sea-fight off Actium 31; fled to Alexandria, and took his own life.

Antwerp. Chief commercial city of Belgium, on r. bank of R. Scheldt, 50 m. from the sea. It appears in history 517, and was a republic in 11th century. Here Alva built a memorable citadel, whence issued "the Spanish Fury," Nov. 4, 1576. A. was taken, after a famous 14 months' siege, by Farnese 1585.



Antwerp Cathedral.

Here a truce for 12 years between Spain and the United Provinces was concluded March 29, 1609. It was taken by Marshal Saxe May 9, 1746: occupied by the French 1794–1814; bombarded by the French Dec. 4, 1832, and surrendered Dec. 24. It has a large commerce and extensive manufactures, especially of silk and lace. Pop., 1891, 227,225.

Antwerp Museum AND GALLERY. Erected 1879–90; contains a fine collection of old Flemish pictures, among them some of the best extant examples of Van Dyck and Rubens.

Anubis. Dog-headed divinity of Egypt, identified with Hermes by the Greeks; in later days worshiped at Rome.

Anura (ANOURA, THERIOMORPHA, CHELONOBATRACHIA, BATRACHIA). Order of *Amphibia*, characterized by a stout body, without tail, with naked skin and well-developed limbs. The vertebræ are procœlous, the eyes have lids, the nostrils are placed far forward, and a tympanic cavity is present in the ear. The vomer, maxillary, and premaxillary bones bear teeth. The tongue is fixed by its anterior end, the hinder being free. Ribs are generally absent. The eggs are surrounded by albumen, which swells in water, where the eggs are spawned. The young hatch as tadpoles, with three pairs of external gills and no limbs. The gills soon give place to internal gills, as in fishes, and an operculum grows back over the gill clefts. The larva has a horny beak, is herbivorous, and has a long intestine. Metamorphosis to the adult carnivorous form takes place by gradual shortening of the intestine, the appearance of limbs, loss of tail and beak and gills. Respiration becomes shifted to the lungs. There are two groups, *Aglossa* and *Phaneroglossa*.

Anus. Opening at the lower end of the intestines, through which the fæces escape; closed by two elastic muscular rings, the external and internal sphincters.

Anville, JEAN BAPTISTE BOURGUIGNON D', 1697–1782. French geographer, who did the best work then known in that field.

Anwari, d. ab. 1200. Persian poet. His *Divan*, a collection of lyrics and elegies, is extant.

Aonia. Early name of Bœotia, which contains Mt. Helicon: hence Aonian is an epithet of the Muses.

Aorta. Large artery through which all of the blood passes out from the heart. See ARTERIES.

Aortic Arches. Arteries in the neck of embryos of higher vertebrates (persistent in adult lower vertebrates), which carry the blood from the heart to the dorsal vessel, which distributes it through the body. In fishes the gills are traversed by them. There are three or more pairs, the lowest vertebrates having the greatest number.

Apaches. Group of Indian tribes belonging to the Athabascan stock, but isolated in Arizona and New Mexico from their northern relations. They have been put on reservations in s. w. Indian Territory, but are restless, warlike, and cruel. In their native home they wore little or no clothing, were omnivorous, ate reptiles, had no religious beliefs, no burial for the dead, no medicine men, and built no houses. They are hairy only on their scalps, lank of body, but capable of great endurance. Their language is deficient grammatically. The Navajos are related, but have better traits; they have a 3,000,000 acre reservation in New Mexico, are farmers, and number ab. 10,000. The name Apache signifies enemy, and has been abundantly supported by atrocities upon the whites.

Aparejo. Back-saddle used in U. S. military service on w. frontier, to transport material by mules over roads or trails impassable for wheeled vehicles.

Apatite. $3Ca_3P_2O_8 + CaCl_2$, or $3Ca_3P_2O_8 + CaF_2$. Anhydrous calcium phosphate, combined with calcium chloride or calcium fluoride, occurring as a mineral; found in greenish, bluish, or brownish hexagonal prisms, and in massive forms. When abundant, as in Spain and Canada, it is utilized in the preparation of mineral fertilizers.

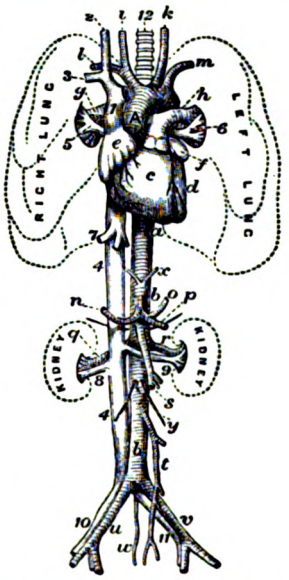


Diagram of the Aorta, with its principal Branches:

A, ascending part of the arch of the aorta; *a*, thoracic aorta; *bb*, abdominal aorta; *c*, *d*, right and left ventricles of heart; *e*, *f*, right and left auricles of the heart; *g*, *h*, right and left pulmonary arteries; *i*, *k*, right and left common carotid arteries; *l*, *m*, right and left subclavian arteries; *n*, hepatic artery; *o*, gastric artery; *p*, splenic artery; *q*, *r*, right and left renal arteries; *s*, *t*, superior and inferior mesenteric arteries; *u*, *v*, right and left common iliac arteries; *w*, middle sacral artery; *x*, phrenic arteries; *y*, spermatic arteries.

1, superior vena cava; 2, right internal jugular vein; 3, right subclavian vein (the left is removed to show the arch of the aorta); 4, inferior vena cava; 5, 6, right and left pulmonary veins; 7, hepatic veins; 8, 9, right and left renal veins; 10, 11, right and left iliac veins; 12, trachea.

Apatosaurus. Lizard-footed Dinosaur, with the vertebræ of the neck, in one species, four feet broad, and a sacrum of three united vertebræ. It is found in the Jurassic of w. N. America.

Apaturia. Annual festival held in many ancient Greek

cities of the Ionian race. At Athens it lasted three days, and was occupied with clan gatherings.

Ape. See CATARHINA.

Apelles, ab. 350–308 B.C. Most famous of Greek painters. Born in Ionia, he lived mostly at the courts of Philip and Alexander.

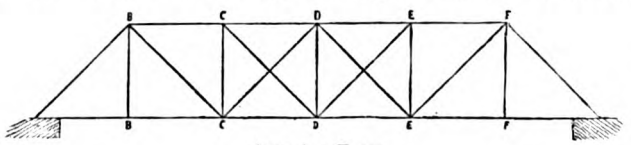
Apennines. Range of Italy, in some sense an offshoot or spur from the Maritime Alps. It traverses the peninsula from n.w. to s. e., divides above the Gulf of Taranto, and runs to the coast on either side. The mountains of Sicily may be considered an extension of the same range. Length ab. 800 m.; average ht. ab. 4,000 ft.; highest summit, Monte Corno, 9,456 ft. Limestone predominates, and the finest statuary marble is quarried at some points, but the southern portion shows rocks of volcanic origin.

Aperients. Cathartics which are mild in action. More commonly termed laxatives, as magnesium citrate.

Aperture. See ORIFICE.

Apet. The Hippopotamus goddess of the ancient Egyptian pantheon, who, like the Lucina of the Greeks, presided over births. She was probably a form of Isis.

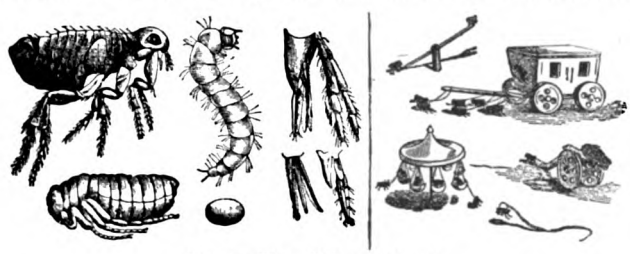
Apex. In U. S. mining law the end or edge of a vein nearest the surface. In a bridge truss, point where two or more



Apex in a Truss.

web members meet the chords. The points marked by letters in the figure are apexes; they are also called panel points.

Aphaniptera (FLEAS). Sub-order of *Diptera*, including forms with laterally compressed body, with the thoracic segments distinct and movable. Wings are rudimentary. The antennæ are short, the proboscis-sheath is formed from the



Human Flea (*Pulex irritans*).

labium; the mandibles are toothed stylets. The larvæ have a distinct head and jaws and live between boards. The human Flea (*Pulex irritans*) belongs here. The back of the male Flea is hollow to receive the larger female. The Chigoe or Sand Flea of S. America bores into the human foot to mature its eggs, and the escaping young produce open ulcers there.

Aphanite. Hornblende rock without distinct grains.

Aphasia. Pathological condition in which the power of expressing ideas by articulate sounds is destroyed or impaired; often associated with the loss or derangement of the power of expressing ideas by written symbols (agraphia), or by gestures (amimia), as well as inability to recognize the use and import of objects (apraxia). The two main varieties are amnesic or sensory, in which the word-memories are lost or interfered with, and ataxic or motor, in which the articulation of the sounds is imperfect or wholly prevented. These two are usually found together.

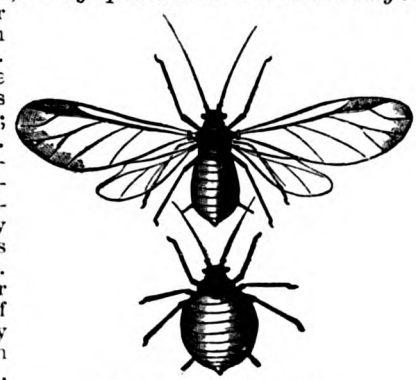
In pure amnesic aphasia, the patient may be unable to understand spoken words (word-deafness), or written language (alexia or word-blindness), or to use words without confusion (paraphasia or heterophasia). In ataxic or motor aphasia the patient is in full possession of the idea he wishes to convey, but is unable to express it in words. In both forms the derangement may be partial or complete. If the aphasia be purely ataxic, the patient recognizes the fact that what he utters is incorrect or meaningless; if amnesic, he may or may not recognize its inadequacy according to the degree of the amnesia.

The most common of the allied disturbances is agraphia. Here the power of writing words may be completely lost, or there may be a confusion in the words produced (paragraphia), or simply a hesitancy or alteration in the handwriting. The two other states, amimia and apraxia, are less common; the former is always associated with aphasia and usually found only in severe or advanced cases. It may exist as an absolute inability to convey ideas by gesture or in a confusion of the commonly accepted gesture signs. Apraxia is also always found associated with aphasia, and varies from hesitancy in the use of objects to complete helplessness.

The pathological condition underlying aphasia is a cerebral lesion, lying usually in the frontal lobe of the brain on the left side, the most constant lesion being that for motor aphasia, situated as a rule in the posterior part of the third left frontal convolution, or its immediate vicinity. The localization of the lesions of the other forms is less constant and more indefinite.

Aphelion. Point of a planet's orbit most remote from the sun.

Aphidæ (PLANT-LICE). *Phytophthires* of the order *Rhynchota*. They have four transparent wings, often absent in the female. They feed on vegetable juices, definite species living on definite plants; and some produce galls. Many have two honey-tubes on the antepenultimate segment, secreting a fluid relished by ants, which sometimes keep them in their nests. Other forms live over winter on the roots of plants. In autumn many of the females, which then are usually winged, produce "winter-eggs," sexually fertilized. The eggs develop in spring into females, usually winged, which produce offspring parthenogenetically and viviparously. During summer several generations of these forms, which are usually apterous, viviparous and parthenogenetic, succeed one another, until finally the cycle is completed by the appearance of true males and oviparous females. The *Phylloxera* of the vine is an example.



Aphis padi (after Kessler).

The figure represents equally well, 1, the autumn forms—the sexual male and the wingless female, the parents of the spring brood; 2, winged and wingless viviparous parthenogenetic forms occurring in spring; and 3, an autumn winged female appearing after a succession of wingless forms.

Aphodal Rhagon. Type of sponge in which the ampullæ are connected to the paragastric cavity by means of excurrent canals and aphodi.

Aphodus. Canal leading water from a sponge ampulla to a general excurrent canal. The ampulla gradually widens into such canal. See PROSODUS.

Aphonia. Loss of voice, due to disease or injury of the vocal organs or interference with their nerve supply; to be distinguished from APHASIA (q. v.).

Aphrodite. Greek goddess of love and beauty, daughter of Zeus and Dione; or, as later poets have it, sprung from the sea-foam: faithless wife of Hephæstus (Vulcan). She received the prize of beauty from Paris. Her magic girdle rendered whoever wore it an object of desire. Sacred to her are the myrtle, rose, apple, the dove, sparrow, swan, etc. Eros is her son, Cyprus and Cythera the chief seats of her worship. She is identified with Venus of the Romans and Astarte of the Syrians.

Aphroditidæ. See ERRANTIA.

Aphrothoraca. *Heliozoa* in which there is no spicular nor gelatinous envelope. These animals have a temporary membranous cyst; *e. g.*, *Actinophrys* and *Actinosphærium*.

Aphthonius, ab. 315. Rhetorician of Antioch. His book, *Progymnasmata*, contained the ancient ideas upon the training of the orator, and was long used as a text-book in the Greek schools, and, after the revival of learning in Europe, during 16th and 17th centuries. He also wrote fables.

Apia. Capital of Samoan Is., w. Pacific. Pop. ab. 3,800.

Apian, PETER (BIENEWITZ), 1495–1552. German mathematician and astronomer, prof. at Ingolstadt ab. 1527. *Cosmography*, 1524.—His son and successor, PHILIP, 1531–1589, wrote on the *Utility of the Cylinder*.

Apical Canals. From the stomach of *Ctenophores* to the aboral pole, where each opens by a pore.

Apical Cell. Wedge-shaped or pyramidal cell which forms the growing point of ferns and other *Pteridophyta*.

Apical Disc. Series of anal, genital, and ocular plates at the aboral pole (surrounding the anus) in Echinoids.

Apical Pole. Aboral pole of Radiates.

Apical Pores. See APICAL CANALS.

Apical System OF ECHINODERMS. Series of plates that lie around the center of the abactinal surface. In the center is a dorso-central plate, around which are five interradial (*basalia*), and five radial (*radialia*). In Starfishes, Ophiuroids, and Crinoids are five underbasal plates, placed radially within the circle of basalia (dicyclic arrangement). In Starfishes, Ophiuroids and

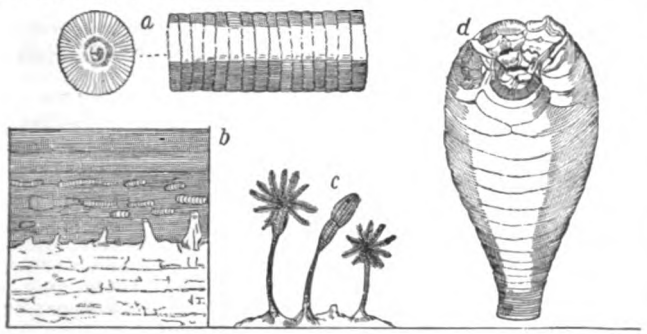
Pelmatozoa, there are also five primary interradials (interbrachials), external to the circle of radials.

Apiculture. The care, management, aud breeding of bees and the production of honey. Bees have been kept for the honey they produce since very early times; but it was not till Langstroth by the invention of the movable frame hive in 1852. made it possible to examine the condition of the colony at any time, that beekeeping was reduced to anything like system. The further invention of a process for removing the honey from the comb by centrifugal force, without destroying the comb, and the use of artificial comb foundations. have led to still further advances in the art of beekeeping. The use of the movable frame hive also renders it possible to remove the young queens before they emerge from the cells and so to largely control swarming, Two kinds of bees are commonly kept, black, or German, and yellow banded, or Italian. The latter are usually considered more docile, better honey gatherers, and less liable to disease. Hybrids of the two races are not uncommon.

Apicius. Three patrician gluttons at Rome; the most famous of them, a contemporary of Tiberius, having squandered most of his estate, took poison. There is a Treatise on the Culinary Art under his name.

Apidæ (BEES). Family of *Aculeata*, having hairy body, broad and hairy tibia and tarsus, especially of the hind legs, for collecting pollen (bee-bread). The anterior wings cannot be folded together. The labium and maxillæ are long, and the latter form a sheath for the tongue. They build nests of wax in hollow trees or in hives. Some lay eggs in cells made by other bees. The Bumble-bee piles up irregular masses of pollen, containing eggs, in holes in the ground. Such nests are started by solitary females that have survived the winter, and the workers, later, assist in rearing the brood, which is never large (50 to 200). For the honey-bee, see APIS MELLIFICA.

Apiocrinite. Crinoids with pear-shaped body; peculiar to the Oölite and Chalk.



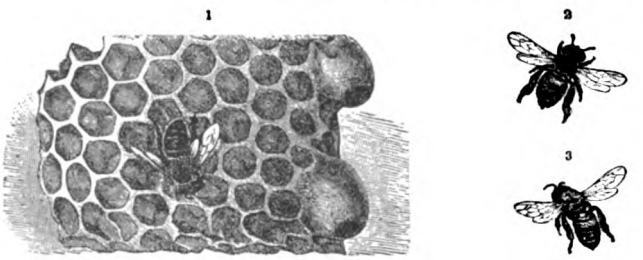
Pear Encrinite (*Apiocrinites rotundus*); Miller. Fossil at Bradford, Wilts.
a. Stem of *Apiocrinites*, and one of the articulations.
b. Section at Bradford of great oolite and overlying clay, containing the fossil encrinites.
c. Three perfect individuals of *Apiocrinites*, represented as they grew on the surface of the Great Oolite.
d. Body of the *Apiocrinites rotundus*.

Apion. Greek grammarian of 1st century at Alexandria; commentator on Homer. He hated the Jews, and Josephus directed a defense of them against him. Fragments of his works remain.

Apis. The sacred bull of the ancient Egyptian pantheon, regarded as the living image of the creative power, Ptah. His temple was at Memphis. He was worshiped alive, and at his death was embalmed and became Osiris.

Tomb of the Apis.

Apis Mellifica (HONEY BEE). Widely distributed; it builds vertical combs (the cells opening on the two sides) of wax, from metamorphosed honey secreted by abdominal glands. Each cell is hexagonal, with a pyramidal base of 3 rhomboidal plates that also form part of the bases of 3 cells on the opposite side of the comb. The smaller cells are filled with food (pollen and honey), and also receive the eggs that become workers. The larger cells are for the drones and honey; ab. 1 per cent of the eggs become drones. A few large and irregular cells, outside, are for female larvæ. Each hive has but 1 queen, who copulates but once in her life of 5 years. Her fertilized eggs become workers in 20 days, unless specially cared for and the young specially nourished, when they become queens, in 16 days. The unfertilized eggs become males (drones) in 24 days, (when workers lay eggs they develop into drones). Before the young queens hatch, the old one departs with a portion of the swarm. The new queen then takes her nuptial flight, is fertilized by a drone and returns to kill her baby sisters (if the swarm is large, the workers prevent this and force her to leave with a part of the colony). The drones are at last killed. Workers have separated eyes and a pollen-brush on the tarsus; drones have eyes in contact, a broad abdomen and no brush; queens have long abdomen and no brush. See APICULTURE.



Honey Bees (*Apidæ*). 1, German; 2, Italian; 3, Egyptian.

Aplacentalia (IMPLACENTALIA, NON-PLACENTALIA, LYENCEPHALA). One of the two great groups of mammals; characterized by the absence of a placenta in the fœtal development. It includes the sub-classes *Prototheria* and *Metatheria*.

Aplanatic. Combination of two or more lenses of different curvatures, so arranged that their respective spherical aberrations neutralize one another. Object glasses of telescopes and microscopes should be aplanatic.

Aplysia. See TECTIBRANCHIATA and CTENOBRANCHIA.

Apocalypse. See REVELATION.

Apocalyptic Number. 666, Rev. xiii. 18.

Apocrenic Acid (HUMIC ACID. ULMIC ACID). When wood or plants decompose in the soil by natural processes, this is one of the resulting products. Its composition is unknown.

Apocrypha. Books admitted by the Greek and Roman churches as canonical, and appended to O. T., but not by Jews or Protestants. Tobit, Judith, Wisdom of Solomon, Ecclesiasticus, Baruch, First and Second Maccabees, etc.

Apocryphal Gospels. Early but unhistorical writings, in character markedly different from the canonical Gospels, and always disowned by the Church.

Apocynaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising 124 genera and ab. 1,035 species, growing generally in the tropics and adjacent warm regions; commonly called the Dogbane family.

Apocynum cannabinum.

Apoda (APODES). Physostome fishes without pelvic fins. The Eels (*Muræniдæ*) are included, as the Conger Eel and Electric Eel (*Gymnonotus*). In the former the shape is serpentine, the skin without scales, and with closely set teeth in the wide mouth. The latter is S. American, often 6 ft. in length, and can kill a large animal by a single shock from the electric organ which is situated in its tail.—Also, a group of Barnacles in which the body is maggot-shaped and consists of eleven rings. The mouth is adapted for sucking; the digestive tract is rudimentary, and there are no feet. They are parasitic and hermaphrodite. See also GYMNOPHIONA.—Also, *Holothurians* without ambulacral feet or respiratory trees. The tentacles are usually branched. They include the *Synaptidæ*. These are hermaphrodite and have anchor spicules in the skin, and no respiratory tree; hence they form the section *Apneumona*.

Here belong also the *Pneumonophora*, including the *Dipneumona* and *Tetrapneumona*. But there are also two- and four-lunged forms among the *Pedata*.

Apodictic. See DEMONSTRATION.

Apogamy. Method of propagation known in certain ferns, in which the fern-plant (sporophyte) is developed from a bud on the prothallium without the intervention of the sexual organs.

Apogee. Point of the moon's orbit most remote from the earth.

Apokatastasis. Perfect fulfillment of God's creative and redemptive purpose in a finally purified and glorified universe.

Apollinarianism. Doctrine of Apollinarius or Apollinaris the Younger, Bp. of the Syrian Laodicea 362–390, allowing to Christ a sensitive or animal soul, but denying a rational human spirit, the Logos being held to take the place of this. He formed a sect 375, and was condemned by Second General Council at Constantinople 381. He and his father produced a poetical version of the Scriptures.

Apollinaris, SIDONIUS, 428–ab.484. Bp. of Clermont in Gaul 473; author of Latin poems and letters.

Apollinaris, SULPICIUS, 2d century. Grammarian from Carthage, teacher of Pertinax and Gellius. The arguments to Terence's and Plautus' Comedies are ascribed to him.

Apollinaris Water. Carbonated table water, containing carbonate of soda, from a spring on the Rhine; exported in large quantities since 1874.

Apollo. Son of Jupiter and Leto, twin brother of Diana; b. in Delos. His chief oracle was at Delphi, from the old name of which, Pytho, he is called the Pythian. He is the god of prophecy, of song and music, of the Sun, and, as the father of Æsculapius, of the healing art.

Apollo Belvedere. Statue in the Vatican, first exhibited in the Belvedere garden of that palace; found 1503 near Antium.

Apollo Belvedere.

Apollodorus, b. ab. 440 B. C. Athenian painter, distinguished as the first to introduce contrasts of light and shadow, the earlier Greek painting having been outline in flat. See POLYQUOTUS.

Apollodorus, OF CARYSTUS, ab. 300–260 B. C. Athenian poet of the New Comedy. Only fragments are left, but Terence took his *Hecyra* and *Phormio* from him.

Apollodorus, OF ATHENS, ab. 140 B.C. Greek Grammarian. His many works are lost, except *Bibliotheca*, the most important ancient book on Greek mythology.

Apollodorus, PROBABLY OF SMYRNA. Greek epigrammatic poet under Augustus and Tiberius. Thirty of his poems, in the Greek anthology, are praised for beauty and simplicity.

Apollonius, OF ALEXANDRIA. Greek grammarian in the time of Augustus. His Homeric lexicon still exists.

Apollonius, SURNAMED DYSCOLUS, 2d century. Greek grammarian of Alexandria, father of Ælius Herodian. Four of his works are extant. His principal service was in reducing grammar to a system.

Apollonius Molo, OF ALABANDA, 1st century B.C. Greek rhetorician who lived at Rhodes and went to Rome as an ambassador 81 B.C.. Cicero studied under him there and later at Rhodes.

Apollonius, OF PERGA, 3d century B.C. Mathematician and astronomer. His book on Conic Sections is extant.

Apollonius, OF RHODES, 280–203 B.C. Greek epic poet; chief librarian at Alexandria after Callimachus. His *Argonautica* was tr. by T. Varro. Virgil and other Latin writers were indebted to him.

Apollonius, OF TYANA, in Cappadocia. Real or mythical Pythagorean mystic, traveler, and wonder-worker of the 1st century, set up by the Neoplatonists as a rival of Christ. His life was written by Philostratus ab. 200, and so much decorated that it is impossible to separate fact from fiction.

Appollonius, OF TYRE. Romance, probably from a Green original of 3d or 4th century, of which Anglo-Saxon and Latik trs. exist, and an abridgement in the *Gesta Romanorum*. Gower made use of it in his *Confessio Amantis*, and Shakespeare in *Pericles*.

Appollophanes. Athenian author of the Old Comedy. Some fragments have come down.

Apollos. Jewish Christian from Alexandria, active in the churches gathered by St. Paul, and by some put above that Apostle; possibly author of the Epistle to the Hebrews.

Apollyon. In Rev. ix. 2, the Angel of the Abyss, the Genius of Destruction. The name is a Greek participle, signifying a destroyer. In Hebrew, Abaddon.

Apologetics. Department of theology devoted to the evidences of the truth of Christianity.

Apomorphine. $C_{17}H_{17}NO_2$. Alkaloid derived from morphine; a powerful emetic, said to be used to excite disgust for liquors, being given simultaneously with them in the beginning of the treatment for drunkenness.

Apophyge. Outward curve of the base of a shaft, connecting the vertical lines of the shaft with the horizontal moldings of the base; commonly separated from the base by a narrow fillet.

Apophyllite. Hydrous calcium and potassium silicate with some fluorine, frequently occurring in beautiful aggregations of crystals as a secondary mineral in cavities in igneous rocks.

Apoplexy. Form of paralysis which occurs suddenly, the patient losing consciousness, which he may or may not regain. Properly restricted to forms due to the actual rupture of a blood vessel in the brain, but popularly including all cases in which there is loss of consciousness with subsequent paralysis of one side of the body. Persons with red face and thick neck are reputed to be particularly prone to this disease, but the theory is not borne out by statistics. A third attack is also held to be necessarily fatal, but it is no more so than that of any other severe disease. Numbness or tingling in various parts of the body aud slight muscular weaknesses are sometimes regarded as premonitions, but in the vast majority of cases are due to entirely different, and as a rule simple, causes. See PARALYSIS.

Aporosa. See MADREPORARIA.

Apostasy. Entire and final defection from Christianity; sometimes misused for defection from a particular form of it.

A Posteriori. Empirical or derived from experience. See A PRIORI.

Apostles. Envoys; the twelve disciples whom our Lord especially commissioned to attest His Resurrection, and to preach His Gospel; extended afterward to St. Paul, as being called immediately in a special way; in a wider sense, used of many others. The *Teaching of the Twelve Apostles* shows the order to have continued, in diminishing importance, till the 2d century.

Apostles' Creed. Shortest and simplest of the great Œcumenical Creeds. It is of universal acceptance, though not traced back of the 4th century.

Apostles' Islands. (1) Group in Lake Superior, belonging to Wisconsin. Missions were established here by the Jesuits; the French settled Madeline Is. 1680. (2) 12 islands in the Straits of Magellan, near the Pacific.

Apostolic Council. Mentioned Acts xv. It decided that the Gentiles need not become Jews in order to be acknowledged as Christians.

Apostolic Fathers. Authors of the Epistles of Barnabas, Clement of Rome, Ignatius and Polycarp, of the Shepherd of Hermas, and of the fragments of Papias, and the Epistle to Diognetus. All these have, with more or less evidence, been regarded as immediate disciples of Apostles, either St. Paul or St. John.

Apostolic Succession. Doctrine held by Roman Catholics, Greeks, and many Anglicans, that (1) the divine right of teaching and governing the Church resides in a succession of bishops, descending unbroken from the Apostles; or (2) that this succession has existed by natural and human continuity, bishops alone having the power to consecrate other bishops and to ordain priests and deacons, and that hence this system is historically necessary to the well-being, if not to the being, of the Church.

Apostolical Canons. Collection, at first of 50, later of 85, ecclesiastical Canons, falsely assuming apostolical authorship; written between 400 and 500.

Apostolical Constitutions. Eight books of ecclesiastical precepts and ritual, falsely pretending to apostolic authorship, but in great part older than the Nicene Council.

Apostrophe. Rhetorical address to a person or thing, present or not.—In botany, position of chlorophyll corpuscles lying

with their longer diameters at right angles to the surface of the organ in which they are contained, and thus parallel to the side walls of the cells.

Apothecary. Retail druggist or pharmacist, who deals in drugs and medicines and compounds physicians' prescriptions. In some States he is required to be a graduate of a School of Pharmacy or to pass an examination, and is not allowed to practice medicine. In England they were originally an inferior branch of the medical profession; but, at present, the licentiates of the Apothecaries' Society of London are, by law, on an equality with university graduates.

Apothecia. Organs of reproduction of lichens and certain ascomycetous fungi. Also called discocarps.

Apothem. Perpendicular from center to side of a regular polygon: equal to the radius of inscribed circle.

Apotheosis. Deification of a mortal. Apart from the mythological stories of demigods of Greece, the term was employed to denote the assumption of the Roman emperors into the ranks of the gods. This gave occasion to a festival, in which the waxen image of the dead was burned upon a pyre of great splendor; an eagle was let go as the fire ascended, and supposed to carry the soul to heaven. Some sixty, from Julius Cæsar to Constantine, received this honor.

Appalachian Mountains. Eastern mountain system of the U. S., stretching n. e. to s. w. from the St. Lawrence to Alabama. It consists in the main of three members, the Blue Ridge, Appalachian Valley, and Cumberland, or Allegany, plateau. The highest summit in the n. is Mt. Washington, N. H., 6,293 ft.; in the s. Mt. Mitchell, N. C., 6,688 ft.

Appalachian Revolution. Term applied by Prof. Joseph Le Conte to the great geological changes that characterized the end of the Carboniferous era in e. N. America. Among these, the most important were the crumpling of the thick palæozoic strata into anticlines from which the mountains have since been carved by erosion, and the permanent elevation of the region above the sea.

Appalachian Tribes. Indians who occupied the S. Atlantic States. (1) The Cherokees were noted for their advanced civilization; they kept slaves to work their farms. One of their number (Sequojah) invented an alphabet for the language after he had caught the idea from hearing about the white man's books. In 1838 they sold their land and were removed to a reservation in n. e. Indian Territory, originally containing 4,000,000 acres. Their government is a democracy. (2) Creeks or Muskogees and Seminoles, etc., who built mounds, made artistic pottery, and had a patriarchal form of government. In 1836, 28,000 Creeks, and, in 1842, 2,400 Seminoles, were removed to the Territory. (3) Choctaws, the most advanced of this group of Indians. 20,000 are in Indian Territory now; they have schools and churches. The Chickasaws, 6,000 strong, and smaller tribes, are also included in this group.

Appalachian Valley. Middle member of the A. mountain system. First seen in Pa.; it runs s. w. to Ala., with the Blue Ridge on the e. and the Cumberland, or Allegany, plateau on the w. Its surface is broken by numerous narrow, parallel, sinuous ridges. It is drained by a series of rivers, the Susquehanna, Potomac, James, Kanawha and Tennessee.

Appalachicola River. It heads in Ga., flows s., forming part of the boundary between Ga. and Ala., and empties into A. Bay, on w. coast of Fla. Drainage area 18,918 sq. m.

Apparent. An adjective much employed by astronomers, as illustrated by the following examples:

The apparent diameter of a heavenly body is the angle at the eye of the observer subtended by the body, and depends upon its actual diameter and distance.

Apparent noon is the instant when the sun is on the meridian, and differs from mean noon by the equation of time.

The apparent place of a star differs from its mean place in consequence of corrections for precession, nutation and aberration.

Apparitions. Those visual sensations, commonly regarded as hallucinatory, of forms and figures not objectively present, but of a distinctness comparable to that of actual sense presentations. The belief that such sensations have an actual objective cause is held by many people, and the whole question is at the present time a subject of active investigation. The main varieties of apparitions may be described as: (1) those of "second sight," or visions which occur coincidently with real events at a distance from the subject; (2) ghosts, or the supposed appearance of the spirits of deceased individuals, and (3) the apparitions of so-called "spiritualistic seances."

There are other visual phenomena which may or may not be classed as apparitions, according to the point of view; such, for example, as the dream images of normal life. See also HALLUCINATIONS.

Appeal. Removal of a cause from an inferior to a superior court for review and retrial. In England, till 1819, it designated also an original suit by which a private citizen sought redress for injury inflicted by a criminal act, while at the same time prosecuting for the crown.

Appendicitis. Inflammation of, or in the vicinity of, the vermiform appendix. A tubular offshoot of the large intestine, on the right side of the body, about the diameter of a goose quill, which in some of the lower animals assists in digestion, but in man is useless. Small bodies, as fruit seeds, pieces of bone, small masses of hard fæces, etc., enter its canal and, if they remain sufficiently long, excite an inflammation which gives rise to an abscess which, if it discharges into the abdominal cavity, arouses a peritonitis, nearly always fatal. Often, instead of the pus taking this course, it escapes into the intestines, or bladder, or comes to the surface, and the disease cures itself. The symptoms are at first apt to be obscure, but after a time resolve themselves into pain and tenderness in the right side just above the hip bone, more or less fever, and signs of a deeply seated abscess. Operation, as soon as there is evidence of the presence of pus, is the only form of treatment which affords any hope of cure; it consists in opening through the side and removing the foreign body which gave rise to the trouble, and, if possible, the appendix itself. The mortality in such cases is relatively small, provided the operation is performed sufficiently early. This disease has been known for more than 2,000 years, but its recognition during life became easy only of late, and only since the time of antiseptic surgery has it lost its fatal character. Formerly it was grouped with a number of other diseases under the head of inflammation of the bowels.

Appendicularia. See COPELATÆ.

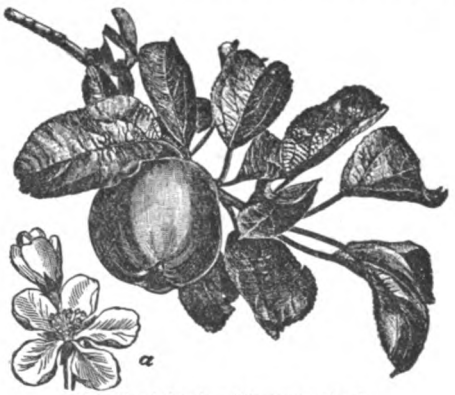
Apperception. Action of the mind in constructing its materials (sensations, memories, ideas) into groups or systems; *e.g.*, when one sees an apple, he proceeds upon the apperception of various sensations, such as taste, color, odor, pressure, etc., which are grouped together to give one thing in space. So, also, all the aspects of things which give us knowledge about them are due to apperception. Technically, it is known as the synthetic function of the mind.

Appetites. Primary and instinctive bodily desires, especially for food and drink, directed toward the preservation of the individual; and the sexual desires, directed toward the preservation of the species.

Appian, 2d century. Alexandrian, author of a Greek work which traced the history of each nation from the time it first came in contact with Rome till its incorporation into the empire. Eleven of his 24 books have come down complete, and parts of others.

Appian Way. Oldest and most celebrated of the Roman military roads; leading first to Capua, later to Beneventum and Brundisium, with branches to all parts of s. Italy; begun and constructed in part by the Censor Appius Claudius Cæcus, 313 B.C. Excavations in 1850–53 reopened the road as far as Albano. The pavement is of large hexagonal blocks of stone, mostly basaltic lava, resting on several different strata of road metal, cemented by lime, under which is the foundation proper.

Apple. Tree of the natural order *Rosaceæ*, *Pyrus malus*, native of w. Europe and Central Asia, now widely cultivated.



Branch of Apple with young Fruit:
a, the blossom.

More than 4,000 varieties are known. 1,450,336 barrels of apples were exported from U. S. to Europe, mainly Great Britain, in 1893.

Apple, ALLIGATOR. West Indian name for *Anona palustris*, tree of the Custard Apple family. The fruit is reported to be greedily eaten by alligators.

Apple of Peru. *Nicandra physaloides.* Herbaceous plant of the Potato family, native of Peru.

Apples of Sodom. Said by ancient writers to grow near the Dead Sea; fair to look upon, but when pressed or struck, exploding like a puff-ball and leaving in the hand but shreds of the rind and a few fibers; the *Calotropis procera* of botanists.

Appomattox Court House, VA. Scene of Lee's surrender to Grant, April 9, 1865.

Apportionment. Distribution of a subject-matter, whether private rights of property, private liabilities, taxes, or political representatives. In the U. S. the basis of representation is settled by a decennial census.

Apposition. Method of increase in size of starch grains by the repeated deposition of layers of starch, or to cell-walls by the layers of cellulose.

Appraisal. Valuation of property by an authorized person, as in case of the goods of one deceased, or of goods set apart to a widow, or property exempt from execution.

Appreciation. In economics, increase in the value of one form of currency or bullion relatively to another existing form, or to other articles of value.

Apprehension. Psychologically, the same as perception; distinguished from comprehension or understanding, as perception is from conception.

Apprentice. One who is bound by an indenture to serve an individual or company for a specified period, and acquire a knowledge of the art or business of his master. Apprenticeship had its origin in the system of trades that prevailed in the Middle Ages. Only those were free to exercise a trade who had served as its regulations prescribed. The system was rendered effective by prohibiting the sale at the great halls established for this purpose of all goods not made by persons who had served their regular apprenticeship, which in many trades was a term of seven years. The system has greatly declined since the division of employments and the introduction of labor-saving machinery, as many learn only one branch or a few branches of a trade, and in a much shorter period.

In common law the contract was usually a written instrument under seal: many statutes require it to be an indenture. It is not assignable.

Approaches. Series of trenches, conventionally three in number, whose general direction is toward the salient of the fortification to be attacked. They zigzag across the capitals, gaining ground to the front, and are connected at convenient intervals by other trenches parallel to the front of attack. They serve as means of approach to positions so near the work that a successful assault may be delivered by the besiegers, or that breaching batteries for its reduction may be established.

Approbation. See APPROVAL.

Appropriation. In economics, reduction to private property of natural objects previously common, especially the natural instruments of production, such as land, water power, and mines.

Appropriation Bills. Laws authorizing the expenditure of money for specified purposes. Those of the U. S. are founded on estimates made by the heads of the different departments, sent to the House, and referred to a committee on appropriations, which examines them and reports to the House for its action. Usually they are passed by that body without many changes, and then go to the Senate for similar action.

Approval. Sentiment which recognizes certain actions or feelings as right.

Approximation. Obtaining values constantly nearer a result not exactly obtainable.

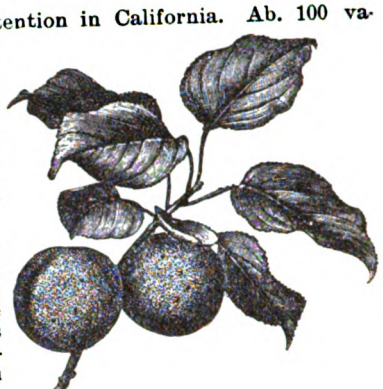
Appui, POINT D'. Point upon which a line of troops is to be formed, or by which it is to be marched; also, advantageous points, such as fortified posts, villages, etc., which will enable an army to secure its position for offensive or defensive movements.

Appulse. Very near approach of one heavenly body to another, as seen projected on the celestial sphere.

Appurtenance. That which is connected with another thing as an incident thereof, as a right of way in case of land, or the equipment in case of a ship.

Apraxia. Pathological state in which the power of recognition of the use and import of objects is lost or impaired; usually associated with APHASIA (q.v.).

Apricot. Bushy tree, *Prunus armeniaca*, of the Rose family, native of Armenia and widely cultivated for its fruit, which resembles both the plum and the peach; its culture is now receiving great attention in California. Ab. 100 varieties are known. It is grafted upon peach and plum stocks.



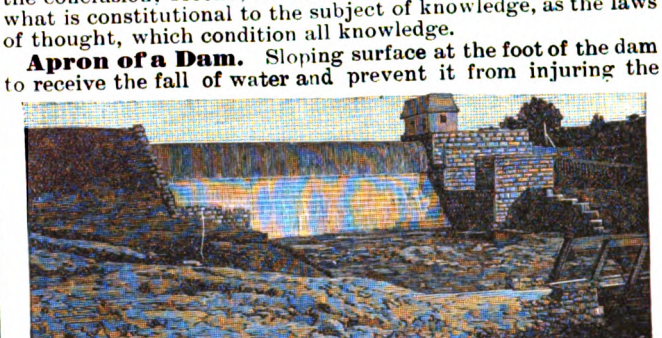
Apricot (*Prunus armeniaca*).

April. Called *Aprilis* by the Romans from *aperire*, to open; the month of opening buds, sacred to Venus. The riotous Floralia was held in this month.

April Fools' Day. Probably originates in New Year's Day of ancient Persia, which fell on the Vernal Equinox. It was a feast of boundless hilarity and absurd rites. In Rome it became the Saturnalia, and in the Middle Ages w. Europe celebrated it as the Feast of Fools.

A Priori. Generally contrasted with *a posteriori* and taken to mean independent of experience. Its two proper meanings are: first, deductive argument where the conclusion follows necessarily from the premises, and represents what may be prior in time, not to all experience, but to such as would verify the conclusion; second, the idealistic meaning which denotes what is constitutional to the subject of knowledge, as the laws of thought, which condition all knowledge.

Apron of a Dam. Sloping surface at the foot of the dam to receive the fall of water and prevent it from injuring the



foundation; made of timber, or, in the best constructions, of stone. The figure shows the Dunning dam at Scranton, Pa.

Apse. Curved or polygonal recess covered with a semi-

Apse of St. Paul-before-the-Walls, Rome.

dome, or vault, or with a timbered ceiling. First introduced by

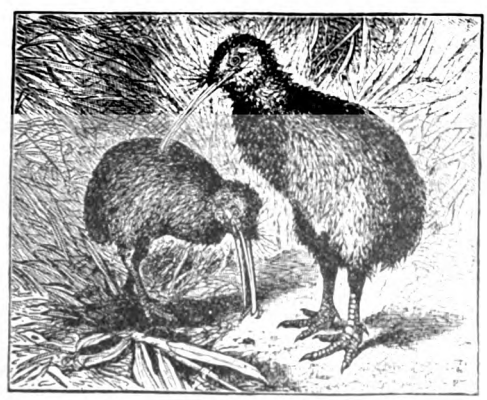
the Roman builders; used occasionally in temples, and a characteristic feature of the basilicas, which were adopted as the types of the early Christian churches. Throughout the Romanesque period, the semi-circular apse was habitually employed as the termination of the choir of churches in Italy, Germany and France. Apses were especially characteristic of the German Romanesque, in which the transepts as well as the choirs frequently had apsidal terminations. In fully developed Gothic, the apse was subdivided by the buttresses into buildings separately roofed, forming a ring of chapels; but this termination, though properly apsidal, is more commonly known by the French term of chevet.

Apsides. In a planet's orbit, the extremities of the major axis of the ellipse, therefore the points where the planet is nearest and most remote from the sun. The line of apsides is the major axis of the orbit.

Apsines, ab. 235. Greek rhetorician of Gadara. Two grammatical treatises of his are extant.

Aptera (PARASITICA). Wingless *Rhynchota* with the mandibles and maxillæ formed into broad, cutting styles. The segments of the body are indistinct. They include the Lice, *Pediculidæ* and *Mallophaga*. See also AMETABOLA and ANOPLURA.

Apterygia. Order of *Ratitæ*, including the Kiwis (*Apteryx*) of New Zealand. These are birds as large as a hen, with hair-like feathers, rudimentary wings, with one phalanx bearing a long claw, short stout scaly legs having three toes



Apteryx.

directed anteriorly and adapted for scratching, and a hind toe, short and raised above the ground. The beak is slender, with the nostrils near its point. They feed on insects by night, live in pairs, breeding twice yearly, laying a large egg, which is incubated in a hole scraped in the ground. The egg weighs fourteen ounces, or a fourth of the bird's weight. They are nearly exterminated.

Aptychus. Flat plate, believed to be the aperculum of an Ammonite. One specimen has been found in proper position to support this view.

Apuleius, LUCIUS, 2d century. Latin author of African birth. His chief work is the *Metamorphoses, or the Golden Ass*, a satire on the morals of the time.

Apulia. Province of s. Italy, on the Adriatic, n. of Lucania. It contains Cannæ, and Venusia, the birthplace of Horace. Conquered by Rome 89 B.C.; by the Normans ab. 1042. Pop., 1890. 1,759,396.

Apure. River of Venezuela, a branch of the Orinoco, formed by the junction of the Orivante and Savare. Length 500 miles.

Apus. See BRANCHIOPODA.

Aquæ Sextiæ. S. Gaul (now Aix); scene of a great victory of the Romans under Marius over the Teutones and Ambrones, 102 B.C.

Aqua Fortis. Old name for Nitric Acid.

Aquamarine. $Be_3Al_2Si_6O_{18}$. Beryllium and aluminium silicate. Deep bluish-green transparent variety of beryl, used as a gem. The finest have been found in Brazil.

Aquapuncture. Injection of water beneath the skin as a counter-irritant in cases of pain.

Aqua Regia. Mixture of 3 parts of hydrochloric and 1 part of nitric acid. It dissolves gold and platinum, due chiefly to free chlorine. Named by Basil Valentine.

Aqua Reginæ. Mixture of sulphuric and nitric acids, used to dissolve silver and separate it from plated articles.

Aquarium. Vessel or tank of water in which aquatic animals and plants may be preserved alive and grown. First used by Sir John Graham Dalyell, of Scotland, for scientific study of marine animals in 1790. The first large aquarium was constructed by the Royal Zoölogical Society of London, in Regent's Park, 1853; and they have been established in several of the large cities of Europe, notably Brighton, England; Hamburg, Berlin, Vienna, and Naples, and also in New York. The ancient Roman *vivaria* were receptacles for water in which fish were fattened for the table.

Aquarius. See ZODIAC.

Aquatic Animals. Those that live either constantly or for the most part in water in which they find their food. They are either air-breathers, or else obtain their air from water, usually by means of gills. Among the former are:—of Mammals, the *Cetaceans* (whales, porpoises), *Sirenia* (manatee), some of the *Carnivora* (seals, walrus), *Rodentia* (muskrat, beaver), *Ungulata* (hippopotamus); of Birds, auks, albatross, gulls, penguins, ducks, flamingoes, pelicans, perhaps also herons; of Reptiles some serpents, also crocodiles and *Chelonia* (turtles); the Batrachians, or *Amphibia*, which however are water-breathers for the most part; the air-breathers (frogs, toads), are so in the tadpole stage. Many insects are aquatic wholly (several aquatic beetles), or in part, as the larval stages of mosquito and dragonfly. Some spiders and several orders of other arachnids are aquatic air-breathers. The greater part of the animal kingdom is truly aquatic, even including such forms as earth worms, land crabs, some land snails, etc., which require that a film of water cover the skin or gills to enable them to secure air for respiration. A person not a naturalist has a very inadequate idea of the distribution of animal life. All the land animals (exclusive of insects), even including aquatic air-breathers, are insignificant in numbers of species and individuals compared with the innumerable forms of protozoa, sponges, hydroids, worms, echinoderms, crustacea, molluscs, tunicates, fishes, etc. that live in the ocean, preying on each other, and ultimately depending on microscopic plants for food and upon the oxygen dissolved in the water.

Aquatic Plants. Include all those vegetable organisms which live in salt or fresh water, either wholly or partly submerged. They comprise a vast majority of the algæ, a few fungi, mosses and ferns, and a large number of flowering plants of many diverse families, chiefly of the *Monocotyledones*. Of the flowering plants the most familiar are the pond-lilies, water-milfoils, bladder-worts, eel-grass, cat-tails, duckweed, sagittarias and pondweeds. Many of the aquatic plants, especially among the algæ, are free swimming, or floating, when they are often supported by air-bladders; the attached algæ fasten themselves by root-like processes to stones, sticks, or other plants, while most of the aquatic flowering plants root in the mud, and often, as in the cat-tails and Sagittarias, rise high out of the water. The pond-lilies and all their relatives in the family *Nymphæaceæ* have long, often thick, rootstocks buried in the mud, the anatomy of which departs from the normal dicotyledonous structure in a remarkable degree.

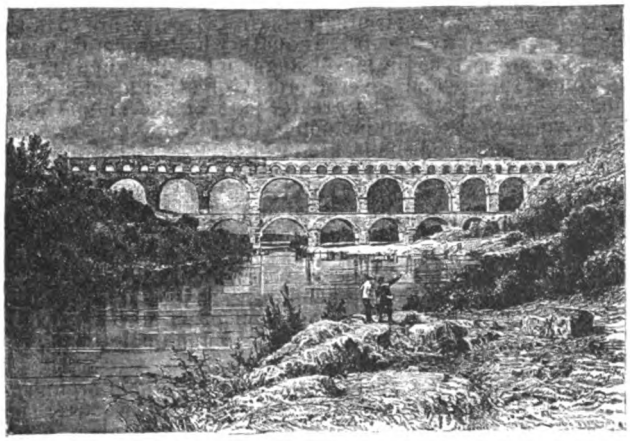
Aquatint. A kind of intaglio work, by which pictures are reproduced in tone-masses instead of lines; capable of some fine artistic effects. The material is a copper plate, properly smoothed and polished, over which is dusted finely powdered rosin, or asphaltum. This is fastened to the plate by carefully heating the under side with the flame of a spirit lamp. Another method of laying a ground is by dissolving rosin in a solution of rectified alcohol and flowing it over the copper, which, when dry, presents a crackled surface, with the bright copper showing in minute specks, giving the plate, when seen under a magnifying glass, a sort of mottled appearance. A third and more certain method of obtaining a perfectly uniform ground is by means of the "whirler." (See PHOTOGRAVURE.) The edges and back of the copper are then covered with the protecting varnish, and placed in a bath of dilute acid, and given a bite over the whole surface. It is then washed with water to stop the action of the acid when it has made a fair impression on the plate. The forms are now laid in with a brush loaded with acid, and the plate can again be bitten by another bath, care being taken to stop out with the varnish those parts which have been carried far enough. The acid, working around the particles composing the ground, produces the granulated masses that make the tone values which we see in the printed impression. This is one of the graphic arts that requires a skilled draughtsman who has had some experience with the materials, as the quality of the print depends largely on the judicious "stopping out" and the skillful use of the burnisher and scraper. Its invention, or discovery, is attributed to Abbé St. Non in the 18th century. It was perfected, it is said, by Jean Baptiste Le Prince, 1733–81.

Aqua Tophania. Preparation of arsenic, sold by a woman, La Tophania, in Italy, early in the 18th century,

mostly to women to kill their husbands. She was executed in Naples 1719. La Sparza, another female dealer in poison, was executed in Rome 1659. More than 600 murders by poison occurred during this epoch in Italy.

Aqua Vitæ. Distilled spirits. The alchemists thought life was prolonged by their use.

Aqueduct. Canal, conduit, or very large pipe through which water flows. The Roman aqueducts were built on masonry arcades, so as to allow the water to flow with uniform slope from the reservoir to the point of supply. Modern aqueducts are sometimes so constructed, and sometimes are below the line of uniform slope, thus being under pressure like a pipe. The Greeks used underground conduits. Eupalinus cut a tunnel at Samos ab. 625 B.C., 4,200 ft. long, 8 ft. broad and 8 ft. high, having a water channel 3 ft. broad and 11 ells deep. At Athens two water conduits passed under the bed of the river Ilissus. Of another Athenian underground aqueduct there are 60 air-shafts remaining, 4 to 5 ft. in diameter. The most imposing ruin of a Roman arcade aqueduct is that at Nimes



Aqueduct at Nimes.

in s. France, which rises in three tiers of arches to a ht. of 180 ft. and has an upper length in crossing the valley of the Gard of 882 ft. The channel resting on these arches is 4 ft. broad, 7 ft. high, roofed over with thick stone slabs, and still covered within with the Roman cement which was used to line all such conduits.

Rome in the time of Frontinus, who wrote on its water supply A.D. 97, had 9 aqueducts, aggregating 250 m. in length, which furnished ab. 137,000,000 gals. per day, or ab. 50 gals. for each person. Later the number of aqueducts was increased to 14, which brought to Rome the water of 18 springs or rivers, distant from 7½ to 44 m. in direct lines; the total length of these was 359 m., of which 55 m. were on masonry arcades. One of these, the Aqua Claudia, is still in use as a part of the present water supply of Rome.

The first large aqueduct in the U. S. was that completed 1841 for supplying N. Y. from the Croton River. It was 40 m. long, of a horseshoe form, 7½ ft. wide by 8½ ft. high, cost $8,600,000, and supplied 60,000,000 gals. per day. This is still in use, crossing the Harlem River over High Bridge. In 1890 a second Croton aqueduct was completed, 33 m. long and ab. 12 ft. in diameter; it crosses the Harlem River by an inverted siphon in a tunnel, and has a capacity of 320,000,000 gals. per day.

Washington, Baltimore, Boston, and other cities obtain their water supply through aqueducts or tunnels which have been constructed at great expense. The amount of water furnished by an aqueduct depends not only on its size, but upon its slope or grade. The slope is usually such that the mean velocity of the water is 2 or 3 ft. per second. A steel pipe 48 inches in diameter and 21 m. long was built in 1892 for the supply of Newark, N. J.

Aqueduct Bridge. Bridge carrying water pipes, or aqueduct over a stream or valley. The High Bridge, carrying the old Croton aqueduct over the Harlem River at New York, is a beautiful masonry structure having 15 arches, 8 of which are of 60 feet span. A suspension bridge at Pittsburg, Pa., has 7 spans, each of 160 feet, the cables carrying the aqueduct being 7 inches in diameter. The Wissahickon bridge at Philadelphia has 4 spans of 166 feet, the water passing through the horizontal upper chords of the trusses, which are 20 inches in diameter. The Rock Creek arch at Washington, D. C., is formed of cast-iron pipes 48 inches in diameter, through which the water of the Potomac aqueduct flows. The Vanne aqueduct for the supply of Paris has numerous arched bridges made of concrete.

Aqueous Fusion. Liquefaction of chemical crystals in water of crystallization.

Aqueous Humor. Thin watery fluid contained in the anterior chamber of the eye, or the space between the posterior surface of the cornea and the crystalline lens.

Aqueous Rock. Composed of material deposited from water.

Aqueous Theory. Promulgated by Werner of Freiburg, attributing the formation of all strata to the action of water. See WERNER.

Aquifoliaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 4 genera and ab. 180 species, distributed throughout all parts of the earth; also known as *Ilicineæ*, and popularly as the Holly family.

Aquila. See EAGLE.

Aquila. Jewish Christian tent-maker who, with his wife Priscilla, or Prisca, befriended St. Paul at Corinth, and instructed Apollos.

Aquila, OF PONTUS, ab. 130. Originally a heathen, he became a Jew, tr. O. T. into Greek, and directed the rebuilding of Jerusalem under Hadrian.

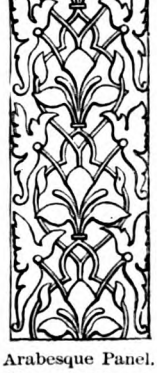
Aquila Romanus, 3d century. Rhetorician, author of a treatise *De Figuris Sententiarum et Elocutionis.*

Aquileia. City of Istria, near the head of the Adriatic; founded 181; destroyed by Attila 452.

Aquinas, THOMAS, 1225–1274. "The Angelic Doctor," b. near Naples. He joined the order of St. Dominic, studied under Albertus Magnus at Cologne and Paris, lectured at Paris and at various Italian universities, and was engaged in many important missions, but refused all preferment. He occupies the highest place in scholastic philosophy, both as to influence and real ability. He distinguished two sources of knowledge, Faith and Reason, and aimed to unite them in his *Summa Theologiæ*, which has dominated the teachings of the R. C. Ch. to this day.

Aquitaine. Province of Gaul, named by the Romans; including first the Iberian territory between the Pyrenees and the Garonne; extended to the Loire by Augustus, subject successively to West Goths and Franks; independent duchy under Merovingians; yielded to Charlemagne, but again became independent; united to France 1137, and to England 1152, in both cases through marriage; finally restored to France 1451.

Arabesque. Kind of ornament not derived, as the name indicates, from Saracenic art; composed of imitations or conventionalizations both of natural and artificial objects, having nothing in common with Arabian ornament except a symmetrical arrangement. The earliest examples are those exhumed at Pompeii. It is referred to disparagingly by Vitruvius and Pliny. Grotesque ornamentation is found in early Christian and in Byzantine art; its revival dates from the 15th century in Italy, when it probably came to be known as arabesque, from a confusion of it with Saracenic decoration.

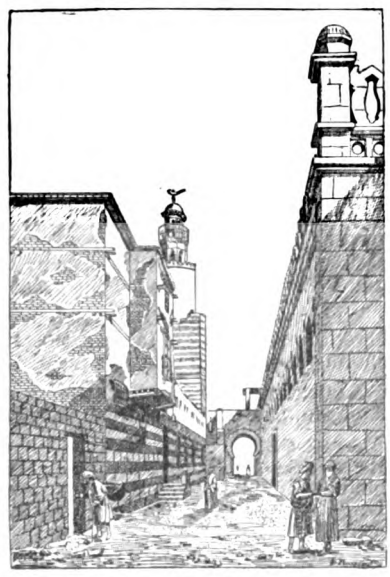


Arabesque Panel. (From the Mosque at Cordova.)

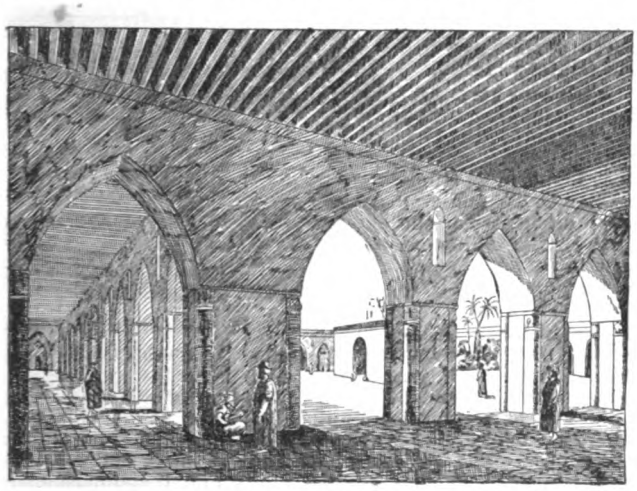
Arabia. S. w. country of Asia; a peninsula, rudely quadrilateral in form; area ab. 1,200,000 sq. m. Its surface is a moderately elevated table-land, gradually rising eastward, with low mountains along its w. border and higher ones on the e. It is in great part a desert, with small fertile sections among the bordering mountains, and in the interior a large region capable of cultivation. It consists of three main divisions: A. Petræa, in the n. w., including the Sinaitic peninsula; A. Deserta, the Syrian desert and part of the interior; A. Felix, the rest of the peninsula, especially the fertile belt on the w. coast. The inhabitants are of Semitic stock, allied to the Hebrews; those of A. Deserta were nomads. The kingdom of Saba seems to have lasted from 1000 to 400 B.C., and, alongside of an Abyssinian kingdom, to A. D. 300 or later. Christianity spread widely at an early day, existing side by side with Sabæism, and became a state religion 525. Mohammed effected a total revolution 622. Pop. ab. 5,000,000,

Arabian Architecture. The Mahometan building not only of Arabia itself, but of Egypt, which is much more exten-

sive and important. The earliest buildings of the Saracens are included in this region. Their architecture is ultimately derived from Persia, but it was powerfully influenced in its development by the Byzantine of Constantinope and of the Levant. The oldest mosques which remain are those of Amrou in Cairo, built 642, and that at Damascus 705. The mosque of Touloun in Cairo, of the ninth century, is especially noteworthy as showing the earliest occurrence of the pointed arch. The principal buildings in this style were mosques often covered with domes, and commonly accompanied by semi-detached minarets, often very elaborate and beautiful in design and in execution. Externally the mosques are more pretentious than the work of the Moors in Spain, and are exceeded only by the monuments of the Mahometans in North India. But what is commonly known as Moorish decoration, as applied to interiors, was



Mosque of Ibm Touloun.



Mosque of Ibm Touloun, Interior.

carried to a much higher point, both of richness and of artistic merit, in the Spanish than in the Arabic development of Mahometan architecture.

Arabian Language. See ARABIC.

Arabian Literature. Its beginnings are hidden in obscurity, and the antiquity of verses said to come from periods before the Christian era is not accepted. But in the 5th century poetry flourished. The metrical systems were based upon quantity, as in Greek and Latin, and 16 different varieties are known to have been in common use. Rhyme came in gradually.

The annual festival of Okad gave the Arab poet his opportunity to compete for prizes and for fame. Heroic poems and elegies of great beauty were produced, the finest of which were hung up for the perusal of the public in some place such as the Káaba at Mecca, where they would reach the eyes of the multitude. Thus 7 of especial merit, the *Múallakat*, or "Suspended," were marked for especial honor.

The Arab was not so successful in prose composition. The Koran, with its almost rhythmic style, introduced the idea of non-metrical writing, and a host of writers arose upon all sorts of subjects, religious, philosophical, and scientific. This was especially the case after the seat of Arab power was transferred to Bagdad, where literature flourished, when Arabia and Damascus had successively declined in power and influence. We may thus divide the literature into Pre-Islamite, previous to 622, and Islamite, the latter falling under the subdivisions of Arabian proper, of which the Koran is the most important, and the Damascene, whose most famous representatives were the poets Omar Ebn Rabeeyah, Jameel, Jareer, Farazdak, and Noseyyeb, who was a negro. The last subdivision covers the later writers at Bagdad and in Spain. During this time the powerful influence of Greek and Persian thought had great effect. The principal poets were Abu-Teman, who also compiled the *Hamasa*, or Golden Treasury, a species of anthology; Mutenebhe, called the finest of them, and, in the 11th century, Toghrai, author of *Lameyyah*, which is said to have furnished Tennyson with the model for *Locksley Hall*. Ebn Faridh about this time wrote a mystical erotic work much praised in all ages. The Spanish Arabs do not seem to have produced original poetical works of value.

But it is in Romance that this period gained its greatest glory, the most famous specimen of which, the *Thousand and One Nights*, is thought to come from Bagdad during the 11th century. Similar productions were written at Tunis and elsewhere. Biography is represented by many works, of which the most famous are the *Kitab el Aghanee*, or Book of Songs, of Abu-Faraj (10th century), which, in 20 vols., comprises brief lives of the chief Arabian poets and musicians, with selections from their compositions; Abdul-Feda's *Life of Mahomet*, and the series of biographies by Koteyah and by Ebn Khallikan of the 12th century. History was mostly in the form of annals of great bulk, but not admirable. Thus Ebn Atheer wrote the world's history to the fall of the Abassidæ. Many others treated of their own periods.

The interpretation of the Koran and other theological subjects gave rise to a voluminous literature. Astronomy, which came from astrology, called a host of books into existence, and this science was carried on with great activity, both in Asia and in Spain. Mathematics and medicine were also pursued with assiduity.

Arabian Nights Entertainment, OR THE BOOK OF A THOUSAND NIGHTS AND A NIGHT. Collection of Oriental tales, according to Burton, of Persian origin, the oldest dating from the 8th century, the latest from the 16th century, the work assuming its present form in the 13th century. The stories are probably folk-lore, attributable to no known author. Three printed editions in Arabic exist, Bulak, 1835; Breslau, 1825–43; and Calcutta, 1839–42. The first European version was made in French by Galland 1704–17, from an Arabic MS., and was tr. at once into English. Translations have been made in German, English and Eastern languages. In English the best are by Lane 1839, an expurgated work, and complete trs. by Richard F. Burton, 10 vols., 1885–86, and John Payne, 9 vols., 1882–84.

Arabian Numerals. 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. Originally Hindoo.

Arabian Sea. Arm of the Indian Ocean, limited on the e. by Hindoostan, n. by Persia and Beloochistan, and w. by Arabia.

Arabic. Semitic language, nearly related to Hebrew, spoken by a vast number of people in Arabia, Syria, Egypt, and elsewhere, and dating its written records from the 6th century. It is the language of the Koran, and has an extensive literature. It was of great importance in the Middle Ages as a vehicle of science and philosophy, and some of its terms (*e.g., algebra, zenith*) are incorporated in English.

Arabine. Potassium and calcium salts of arabic acid, $2C_6H_{10}O_5,H_2O$.; secreted by many plants. It dissolves easily in water, and constitutes the gum arabic of trade.

Arabinose. $C_5H_{10}O_5$. Aldehyde of arabic acid.

Arabi Pasha (AHMED-EL-URABY). b. ab. 1835. From a private in Egyptian army he rose to high rank, claimed to be inspired, and became leader of a rebellion. England interfered; A. suffered a total defeat at Tel-el-Kebir Sept. 13, 1882, surrendered, and after being sentenced to death was exiled to Ceylon.

Arabs. Race claiming descent from Joktan, grandson of Shem, and from Ishmael. Those of Yemen and some others dwelt in towns, carried on commerce and agriculture; the rest were nomadic. Trajan invaded Arabia A.D. 107. Society became disorganized; feuds and internal warfare prevailed. After their conversion to Mohammedanism the Arabs became a united and powerful people, extended their sway over a great part of w. Asia and n. Africa, and founded an empire in Spain. Their dominion lasted for more than 600 years. The Califat of Bagdad fell 1258. The Turks conquered Yemen in the 16th century, but were expelled in the 17th. The Portuguese held Muscat 1509–1659, and the Persians gained some victories in the 16th century. In 1770 Ibn-abd-ul-Wahàb undertook to revive pure Mohammedanism. His followers, the Wahabis, propagated their doctrines by the sword, and extended their influence over a great part of the peninsula. Their piracies in the Persian

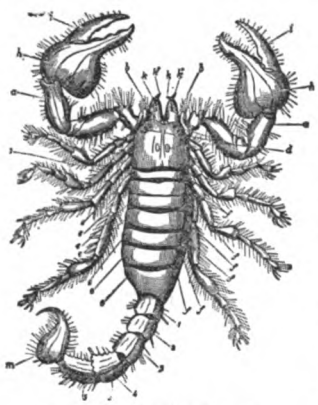
Gulf were chastised by Great Britain 1808. Their interruption of pilgrim caravans approaching Mecca led the Sultan to charge Mehemet Ali with the recovery of the Holy places. Medina was taken 1812, Mecca 1815, and in 1818 Ibrahim broke for a time the power of the Wahabis, but Mehemet Ali's death put an end to these efforts, and they became more powerful than before. Civil war broke out 1870, and the Ottoman power interfered, with only partial success. The Nedjed empire still holds sway, and resists the entrance of civilization.

Araceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Monocotyledones*, comprising 105 genera and ab. 900 species, widely distributed throughout the tropical and temperate zones; commonly known as Aroids, and including the Calla, Jack-in-the-Pulpit, and Skunk-cabbage.

Arachinic, or ARACHIDIC, **Acid.** $C_{19}H_{39}.COOH$. Mpt. 75° C. Found combined with glyceryl in peanut oil and in some other fats; prepared by the saponification of peanut oil.

Arachne. Maiden of Lydia, skilled in weaving and embroidery, who challenged Minerva to a trial of skill; being struck by the goddess, she hanged herself, and was changed into a spider.

Arachnida. Air-breathing Arthropods with a cephalothorax, two pairs of jaws, four pairs of walking legs, and apodal abdomen, of variable form. Mites, Scorpions, and Spiders are examples. The class comprises the orders *Linguatulida*, *Acarina Pycnogonida*, *Tardigrada*, *Araneida*, *Phalangida*, *Pedipalpi*, *Scorpionidæ*, *Pseudo-scorpionidæ*, *Solfugæ*. Some authors include *Limulus*. See also MONOMEROSOMATA and ADELARTHROSOMATA.



Scorpion (*Buthus heros*).

a, a, palpi, of which *h, h*, are the digital or fourth joints, and *i, i*, the movable fingers; *b, b*, falces, with two movable fangs, *k, k*, and two fixed ones k^*, k^*; *d*, eyes; *e...e*, upper segmental plates of abdomen; *f. f*, articulated cartilaginous membrane, connecting upper and under plates of abdomen; *m*, bulbous sting.

Arachnidia. Glands that supply the material for the threads of a spider's web.

Arachnoid Membrane. Delicate serous membrane between the dura mater and the pia mater, which secretes the cerebro-spinal fluid.

Arachnology. Science of spiders and other arachnids.

Araeostyle. In classic architecture, an order in which the columns are widely spaced, the intercolumniation being greater than three diameters of the column.

Arago, DOMINIQUE FRANÇOIS, 1786–1853. French physicist and astronomer; employed by the government 1806, with Biot, to measure the supplementary arc of the meridian between Barcelona and the Balearic Isles; sec. Bureau of Longitudes 1805, member of the Institute 1809, prof. in the Polytechnic School 1810, founder, with Gay-Lussac, of the *Annales de Chimie et de Physique*, 1816, director of the Paris Observatory 1830, and perpetual sec. Academie des Sciences. He took an active part in the revolution of 1830, and was elected to the Chamber of Deputies in 1831 as an advanced republican. In 1848 he was a member of the provisional government, and acted as minister of war and the marine under Lamartine. He was elected to the National Assembly, opposed the election of Louis Napoleon, and after the coup d'état of 1851 refused to take the oath of allegiance. His chief scientific work was in astronomy, optics and electro-magnetism. He discovered the mutual action between a conductor and a moving magnet, for which he was awarded the Copley medal of the Royal Society 1825. His *Astronomie Populaire*, 1812, is among the best known of his many works.

Arago, ETIENNE, 1802–1892. French dramatist, journalist and statesman, exiled 1849; brother of D. F. *The Aristocrats*, 1847.—His brother, JACQUES ETIENNE VICTOR, 1790–1855, wrote several books of travel.

Arago-Davy Actinometer. Pair of thermometers, one having a blackened bulb and the other a bright bulb, inclosed in larger glass bulbs from which the air is exhausted, the whole exposed to the sun's radiation; also called black and bright bulb thermometers in vacuo.

Arago's Disc. Arago observed in 1825 that by rotating a copper disc near a freely suspended magnet, so that the plane of the disc was parallel to the plane of motion of the magnet, the latter would be rotated in a similar direction. The effect decreases with distance and varies with the nature of the disc. Faraday explained the phenomenon by showing that currents are generated in the disc, which, reacting upon the magnet, cause its motion.

Arago's Law. When radiation is partly reflected at, and partly transmitted through, a transparent surface, the reflected and transmitted portions contain equal portions of polarized radiation, the planes of polarization being at right angles with each other.

Aragon. Early kingdom of Spain in n. e. corner of the peninsula; originally, 760, a small county e. of Navarre; united to Navarre by Sancho, 1000–35. Christian kingdom was founded 1035, and embraced possessions beyond the Rhone 1131, which were lost 1229. The Balearic Isles and Valencia were added 1228–36, Sicily 1282–85 and 1409, Sardinia 1428, and Naples 1442–58. Its union with Castile by the marriage of Ferdinand and Isabella 1469, founded the great Spanish monarchy.

Aragonite. $CaCO_3$. Calcium carbonate, orthorhombic crystallization. Calcite has the same composition, but is rhombohedral in crystalline form.

Araguay. Branch of the Tocantins, tributary to the Amazon, in Brazil; length ab. 1,300 m.

Aral Sea. Large lake or inland sea of w. Turkistan or Russian Asia. It receives the waters of numerous streams, including the Oxus, but has no outlet, and its water is salt. Length 300 m., breadth 100 to 240 m. Altitude above Caspian Sea 240 ft.

Araliaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 51 genera and ab. 375 species, distributed throughout the temperate and torrid zones of the whole earth; commonly called the Ginseng family.

Chinese Rice-paper Tree (*Aralia papyrifera*).

Aramaic. Old Semitic language, with inscriptions dating from 8th century B.C. It is found in portions of the O. T., and was used along with the Hebrew, becoming at last the common speech of the Jews. See SYRIAC.

Araneida, ARANEINA, or SPHÆROGASTRA (SPIDERS). Arachnids with poison glands in the cheliceræ, with footlike pedipalps, and a globose, unsegmented abdomen, joined to the thorax by a stalk. They have 4 (or 6) spinning mammillæ, and 2 (or 4) breathing sacs. There are 8 (or 6) simple eyes, whose arrangement characterizes the genera. The *Tetrapneumones* have 4 lungs and 4 spinnerets; the *Dipneumones* have 2 lungs and 6 spinnerets. See SPIDERS.

Arany, JANOS, 1817–1882. Hungarian poet.

Arapahoes. Tribe of N. American Indians originally occupying region between Platte and Arkansas rivers. Associated with Cheyennes; warlike and brave, enemies of Utes and whites. Now on reservations in w. part of Indian Territory and of Wyoming. Both tribes numbered, 1890, 3,363.

Arar. See SANDARACH.

Ararat, Mt. Peak at the junction of the boundaries of Russia, Persia and Turkey. Altitude 17,260 ft. Another peak of this range is supposed to have been the spot on which the ark rested.

Aratus, 270–220 B.C. Greek astronomer and poet of Soli in Cilicia, whose *Aspects of the Heavens* was quoted by St. Paul, Acts xvii. 28.

Aratus, OF SICYON, 271–213 B.C. General of the Achæan League from 245.

Araucanians, or ARAUCARIANS. Indian tribe of s. Chili, who long maintained their independence; celebrated by Ercilla in his epic *Araucana*, ab. 1560. A French lawyer, De Tonneins (1820–1878), was "King of Araucania" for a few months in 1861. The natives submitted to the Chilian government 1870. They are small and brown, with small skull; they cultivate the ground to some extent, and possess large flocks, but the women do most of the work. Polygamy is practiced. They believe in immortality, but have no temple or system of worship. The Eastern Araucanians, or Pampas Indians, are governed by a system of absolutism. They number ab. 30,000.

Araucaria. Large trees of the Pine family, native in Chili, Brazil, and the Pacific Islands.

Branch of *Araucaria imbricata.*

Araucarioxylon. Fossil tree, formerly supposed to be a conifer, but now classed with *Cordaites;* synonymous with *Dadoxylon.* It was first found in the Middle Devonian.

Araujo Porto Alegre, MANOEL D', b. 1806. Brazilian artist, dramatist, and poet.

Arbela. City of Assyria, about 50 m. w. of which Alexander overthrew Darius 331 B. C., in the so-called battle of Arbela.

Arbitrage. Business of buying or selling stocks, bonds or funds of any kind, by which advantage is taken of any temporary difference between the exchange quotation at one place and its counterpart at another. Those who engage in it are called arbitrageurs.

Arbitrary Quantity. One whose value is at will. See CONSTANT.

Arbitration. Decision or award of a matter of dispute between parties by unofficial persons. If the defeated party refuses to abide by the award, it cannot be enforced by execution, like the judgment of a court, but must be sued on by the successful party. Modern statutes frequently encourage arbitration, and provide for the summary enforcement of awards. In England a statute was passed 1867 to establish councils of conciliation and arbitration. The courts of prudhommes in France are of a similar character. The court is composed of master workmen, or manufacturers, and of foremen, six of each class, one half the number going out annually.

Arbitration Board. Tribunal established by statute in many States for settling labor disputes. Often the board consists of three persons appointed by the Governor. One of them is an employer of labor, or a representative of that class; another is a representative of a labor organization, or is an employee; the third is appointed on the recommendation of the other two. If the two do not recommend a third man within a fixed period, he is appointed by the Governor without recommendation. Whenever a dispute arises between an employer and his employees, either party may make an application to the board for a settlement of the controversy. A majority, or more, of the employees must unite in making the application. The board visits the locality of the dispute, makes inquiry into the causes of it, takes testimony, examines books, etc., and within a fixed time renders a decision, which is binding on both parties for a fixed period, usually six months. In some States the board is organized in a different manner. Either party may apply to the court for the appointment of arbitrators; each party appoints one or more, usually three, and the court three more. This board hears the parties and takes such additional testimony as may be deemed needful. In Mass. and N. Y. such boards have been in existence for several years. Local boards of arbitration for the settlement of a particular dispute, by agreement of both parties, have often been established. One of the most noteworthy cases is that between the Lehigh Valley R.R. Co. and its employees in 1893, settled by the State boards of N. Y. and N. J.

Arbogast, LOUIS F. A., 1759-1803. French mathematician: rector Univ. Strasburg; *Du Calcul de Derivations,* 1800.

Arbor Day. School holiday in most States, for tree-planting; initiated in Nebraska 1874.

Arboretum. Park or garden devoted to the cultivation of trees. The Arnold Arboretum of Boston, Mass., is the most extensive in the U. S. It was established by a bequest of James Arnold of New Bedford, Mass.

Arbor Saturni. If a piece of zinc be placed in a solution of a lead salt, the lead is precipitated in arborescent crystals; called also the "lead tree."

Arbor-vitæ. Trees of the genus *Thuja,* natural family *Coniferæ,* natives of the northern hemisphere. The e. American Arbor-vitæ is *T. occidentalis,* and is abundant in the n. e. States.

Arbués, PEDRO, 1441-1485. Spanish inquisitor under Torquemada; killed in revenge by relatives of his victims; beatified 1661, canonized 1867.

Arbuthnot, JOHN, M.D., F.R.S., 1667-1735. English mathematician, philosopher, and wit. *Laws of Chance; History of John Bull,* 1712.

Arbutin. $C_{12}H_{16}O_7$. Glucoside found in the bearberry; decomposed into dextrose and hydroquinone.

Arbutus. Small evergreen tree of the natural order *Ericace,æ* native in s. Europe.

Arbutus, TRAILING. *Epigæa repens.* Evergreen plant, bearing in early spring a profusion of white and pink odorous blossoms; of natural order *Ericaceæ,* native of e. N. America; known also as Ground Laurel and Mayflower.

Arbutus unedo:
a, fruit; *b,* section of fruit.

Arcade. Series of arches; common feature both of construction and decoration in all styles of architecture that employ arches. The Romans did not develop it architecturally, but made extensive use of it in works of utility, especially in

Basilica of Vincenza, Italy.

aqueducts. In Saracenic, Romanesque and Gothic work it is used freely for decorative purposes, often without structural necessity, and with its openings backed by walls. In this case it is known as a blind or mock arcade.

Arcadelt, JACOB. Dutch composer of 16th century, master of the boy-choir in St. Peter's, Rome, 1539; voluminous writer of ch. music and madrigals. The authenticity of the *Ave Maria* attributed to him and transcribed by Liszt has been disputed.

Arcade Railway. Running beneath an arcade or roofed passage, usually below the pavement of a street; *e. g.,* the tracks of the N.Y. and New Haven and N. Y. Central railroads in N.Y. city.

Arcadia. Central district of Peloponnesus; the Switzerland of Greece. The Arcadians were huntsmen and shepherds, fond of music, worshipers of Pan and Artemis.

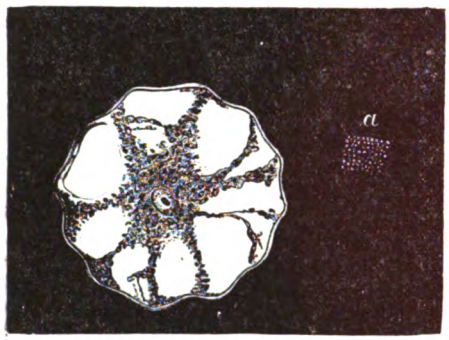
Arcadius, OF ANTIOCH, 3d century. Greek grammarian, whose treatise upon accents still exists.

Arcadius, b. 377. Son of Theodosius; emperor of the East 395-408; his brother HONORIUS having received the West.

Arcani Disciplina. Instruction in hidden things, given only to the baptized, or to communicants. This reserve was imposed upon the Church during the Pagan persecutions, and maintained for some time after, mere attendants not being allowed, *e.g.*, to witness the Eucharist. The term was first used 1666, and the matter is in dispute to some extent.

Arc Circular. Arc of a circle. Its unit of measure is the degree, $= \frac{1}{360}$ of the circumference. The degree (°) is divided into 60 minutes (′), the minute into 60 seconds (″). The arc of 90° is a quadrant. The arc is also measured in terms of π (=3.14159+) which is the ratio of the semicircumference to the radius. As angles at the center of a circle are proportional to the intercepted arcs, arcs are taken as the measures of angles.

Arcellina, or TESTACEA. Order of *Lobosa*, characterized by having the sarcode body enveloped by a horny shell (arcella), or one made of grains of sand cemented together (difflugia). There is one opening to this shell, through which the club-shaped pseudopodia are thrust out in search of food. Reproduction is usually by simple fission, one-half of the original animal retaining the old shell; the other half, or daughter-cell, secretes its own new shell.



Arcella vulgaris. *a*, Part of Shell.

Arcesilaus, ab. 316–241 B.C. One of Plato's successors at Athens, founder of the New Academy, an eclectic and sceptic.

Arch. The architectural employment of the arch is much more recent than its structural use. It first appears in Roman buildings, but scarcely in any other capacity than that of a structural expedient, the ornamentation of it being confined to simple moldings, while walls pierced with arches were faced with representations of columnar architecture. The palace of Diocletian at Spalato, 303, was the earliest building in which the arch is known to have been used as the chief element of decoration as well as of construction. The Romanesque arches, like the Roman, were semi-circular. The first appearance of the pointed arch is believed to have been in a mosque of the 9th century at Cairo. The exigencies of the vaulting system in early Gothic, and the necessity of using adjoining arches of different spans and the same height, compelled the introduction of the pointed arch, which is popularly accepted as the distinguishing mark of the Gothic style. Semi-circular and pointed are the principal forms, but in late Gothic 3-centered, 4-centered segmental and elliptic arches are also used, and in Saracenic architecture the horse-shoe form.

Stone arches are used for culverts and bridges, while those of brick are mainly employed in buildings and tunnels. The longest span of a stone arch is that of the Cabin John bridge on the Washington aqueduct, 220 ft. Timber and iron arches are employed for roofs and bridges, the largest span being that of 541 ft. in a viaduct in France. The largest roof arch was in the Liberal Arts building, Chicago, 1893, 368 ft. span.—In mining, an arch is a portion of a vein left standing to support a roadway or a weak wall.

Arch, JOSEPH. b. 1826. English labor leader, M.P. 1885 and 1892.

Archæan. Laurentian and Huronian systems, or their equivalents taken together; by some geologists held to include all rocks older than the Cambrian. The ARCHÆAN ERA was that geological period of time during which were formed the oldest rocks not containing fossils. Also called Azoic.

Archæoceti. Sub-order of *Cetacea*, including the extinct *Zeuglodon*, a whale 70 ft. long, found fossil in the Miocene deposits of America. It had pointed, serrate teeth implanted by two roots, and a long, narrow skull. It connected the whales and aquatic carnivora.

Archæocytes. Amœboid cells imbedded in the gelatinous matrix of sponges. They are either scavengers, like *Leucocytes*, of higher animals, or else are newly immigrated cells from the ampullæ, that are to become reproductive cells.

Archæology. Science of history as revealed and illustrated by its surviving relics and monuments. It therefore includes the history of art, and is mainly coextensive with it, as few even of the utilitarian objects made in the past were destitute of ornamental emphasis and treatment. It refers especially to classic and oriental antiquity and to prehistoric times.

Archæology, BIBLICAL. Study of ancient literature, art, inscriptions, coins, etc., as illustrating the Scriptures; treated by J. Jahn, 1796–1805 (tr. 1823), E. C. Bissell, 1888, and many others.

Archæophyton. Graphitic remains of a supposed seaweed, found 1887 in the white crystalline Laurentian limestone, Sussex Co., N. J.

Archæopteris. Genus of Upper Devonian ferns with large and luxuriant fronds; abundant in the plant-beds of Kiltorcan, Ireland, and found in the Catskill sandstones of n. Pa.

Archæopteris Halliana.

Archæopteryx. Jurassic fossil with long, reptilian tail, and toothed jaws. By some it is considered the remains of a bird, by others of a feathered reptile. The first specimen, found 1362, is in the British Museum. The second, found 1884, was purchased for the Museum at Berlin. Both came from the lithographic limestone quarry at Solenhofen, Bavaria.

Archæostomata. Group of worms comprising the *Turbellaria*, *Cotylidea*, and *Nematelmia*.

Archæsthetism. Earliest or most primitive sensibility of living things; simplest or earliest function of consciousness in creation. See PANÆSTHETISM.

Archangel. City and seaport of Russia, on r. Dwina; founded 1584. Pop. ab. 20,000.

Archangel, GULF OF. Indentation into the Russian coast from the White Sea.

Archbishop. Anciently, a Greek patriarch; usually head of a province including dioceses and bishops. The English Ch. has two, Canterbury and York.

Archdeacon. Originally the chief deacon in a great church, who, as bishop's confidant, attained to inordinate authority; now little more than a titular dignitary.

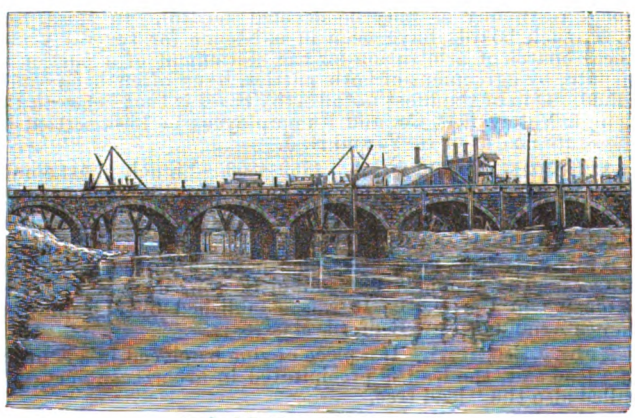
Archdiocese. Properly, an archbishop's diocese; often, though inaccurately, an archiepiscopal province. Term seldom used.

Archduke. Austrian title, assumed 1359, admitted 1453; now given to sons of the emperor.

Archebiosis. See ABIOGENESIS.

Arched Beam. Usually built of planks, bent so as to resemble an arch in shape. They are used to stiffen structures rather than to carry weight.

Arched Bridge. Arched stone bridges built by the Romans are yet standing, and during the Middle Ages many were erected, the longest span being 184 ft. An arch built during the 14th century over the Adda in Italy is said to have been 250 ft. in span. The longest existing arched spans of stone are those of the Cabin John Bridge in Md., and the Chester Bridge in England, 220 and 200 ft. respectively. Stone bridges are more durable than iron ones, but also more expen-


Arched Bridge, Johnstown, Pa.

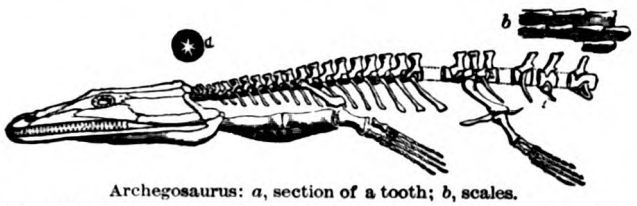
sive. Concrete has lately been used for arched bridges of small span. Timber arches of framed and jointed pieces were formerly much employed for bridges; some of those in Trajan's bridge, built 105, were 180 ft. in span. Cast-iron bridges were first constructed during the latter part of the 18th century, the longest being the 240 ft. spans at Sunderland and Southwark, England. Wrought-iron and steel arches are now extensively used for bridges, the longest being that in the Garabit viaduct in France, whose span is 541 ft. The longest span of the steel arch of the Washington Bridge over the Harlem R., N. Y., is 508 ft., and that of the St. Louis bridge over the Mississippi is 515 ft. The figure shows the bridge at Johnstown, Pa., which resisted the destructive flood of 1889.

Arched Dam. Built in a curve across a river, the convexity being up stream. It resists water-pressure like an arch if it is built against shore abutments, but when these are lacking the arched form adds nothing to the strength.

Archegastrula. Primitive *gastrula*, now seen most nearly represented in *Protohydra*, an animal like *Hydra*, but without tentacles.

Archegone (ARCHEGONIUM). Female organs of reproduction of ferns, clubmosses, horsetails, true mosses, liverworts, etc. They are minute sacs, each containing a specially modified cell or oösphere, which is fertilized by the action of the antherozoids.

Archegosaurus. Small air-breathing amphibian, prob-



Archegosaurus: *a*, section of a tooth; *b*, scales.

ably allied to Labyrinthodon; found in the coal field of Saarbrück, Germany. See LABYRINTHODONTA.

Archelaus. Athenian of 5th cent. B.C., addicted to physical speculations; pupil of Anaxagoras and teacher of Socrates.

Archelaus. King of Macedonia 413–399 B.C.

Archelaus. Gen. of Mithridates; defeated by Sulla; he joined the Romans 81 B.C. His son married Berenice of Egypt, and d. 55 B.C.

Archelaus, d. 6. Son of Herod the Great, and his successor, 4 B.C., in the government of Palestine; allowed by Augustus the title of Ethnarch of Judea, Samaria, and Idumea; deposed and banished to Gaul A.D. 5. It was through fear of him that Joseph and Mary removed with the infant Jesus to Nazareth in Galilee.

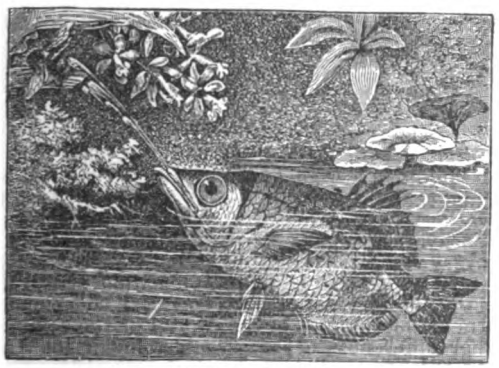
Archencephala. Sub-class of Mammals, including only Man; characterized by having cerebral hemispheres that completely overlap the olfactory lobes and cerebellum.

Archenholz, JOHANN WILHELM, BARON VON, 1745–1812. Prussian historian. *Seven Years' War*, 1793.

Archenteric Diverticula. Pouches from the Archenteron, which produce the mesoblast, and whose cavities become transformed into the body-cavity; seen best in the development of *Amphioxus*.

Archenteron. Earliest digestive cavity formed in the embryo; the gastrula cavity, as typically formed by invagination. In polyps it remains as the adult gastrovascular or gastrocœliac cavity.

Archer Fish. Small Polynesian and East Indian fish, of



Archer Fish (*Toxotes jaculator*).

genus *Toxotes* and family *Toxotidæ;* said by many ichthyologists to have power of catching insects by spouting small jets of water over their prey in such a manner as to cause it to fall within their reach.

Archery. Contest with bows and arrows, formerly a branch of military service in many nations; found to-day chiefly in Korea, where archery contests, called *pun sa*, or "side-shooting," form the amusement of a large class, *Hwal yung*, enrolled in societies named and corresponding with the four directions, and carrying banners with the colors assigned in China and Korea to the cardinal points. Archery contests remain in Korea, as formerly in China, the only test of skill in the government examinations for military rank.

Arches, COURT OF. In province of Canterbury. It has a dean, who assists the Abp.

Archespore. Cell or group of cells in the formative state of the sporange of the *Pteridophyta*, from which the spores are developed; also, cells which develop into the pollen-sac of flowering plants.

Archiannelids. Group of Annelidan worms, including *Polygordius* and *Protodrilus*. These are polychætous forms, or allied to them, but have no parapodia nor setæ, and have lost the external segmentation of the body (present in the larva). The segments are homonymous; hence they are considered the ancestors of the annelids.

Archias, AULUS LICINIUS, b. ab. 120 B.C. Greek poet, resident at Rome; chiefly known through an oration of Cicero in his defense.

Archibald, EDMUND DOUGLAS, b. ab. 1840. Prof. at Allahabad, India; inventor of a hollow kite for observing atmospheric conditions at any altitude, and first to determine the velocity of wind in upper strata in free air.

Archiblast. Formative yolk or germinal protoplasm of eggs.

Archicarp. In botany, cell or group of cells after fertilization.

Archicercal Tail. Embryonic tail of vertebrates, especially fishes, before the fin-rays appear.

Archicœl. Earliest cavity present in the embryo; occurring in the blastula stage. See SEGMENTATION CAVITY.

Archidamus. Kings of Sparta ab. 470–427, 361–338, and 240 B.C.

Archidiaceæ. Order of small mosses, including only the genus *Archidium*.

Archigastrula. Simplest or most primitive form of gastrula, from which all other sorts of gastrula can be conceived as having been evolved. It is formed by total and equal segmentation of an archicytula.

Archigonia. Genesis of the first living matter. See SPONTANEOUS GENERATION.

Archil. Dye-stuff containing Orceine ($C_{14}H_{13}NO_4$), prepared from the lichen *Roccella*, by treatment with ammonia; used for dyeing wool browns, reds, etc.

Archilochus, ab. 714–676 B.C. Greek poet, of Paros, author of hymns, elegies, and iambic satires; said to have invented the latter.

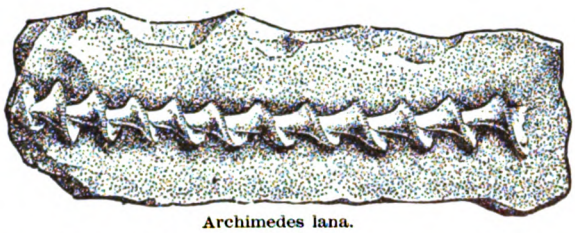
Archimalakion. Simplest and most primitive mollusc, from which other molluscs may be conceived to have been derived, by development and differentiation of organs.

Archimandrite. Abbot in Greek Ch.

Archimedes, 287–212 B.C. Greek mathematician of Syracuse; only one of the ancients who added anything of value to the theory of mechanics and to hydrostatics. He first discovered the truth that "any body immersed in a fluid is buoyed upward with a force equal to the weight of the displaced fluid." By this law he discovered the fraud practiced on King Hiero by a goldsmith, whom he had ordered to make a crown of pure gold. The method occurred to him as he was entering the bath, and he is said to have run home naked, exclaiming, "Eureka! (I have found it!)" He boasted that he could move the world if he had a fulcrum for his lever. He invented the endless screw and the ARCHIMEDES' SCREW (q.v.). While in the act of drawing geometrical figures in the sand, he was killed by a Roman soldier. Extant works edited by Torelli, Oxford, 1792: *On the Sphere and Cylinder; The Measurement of a Circle; On the Equilibrium and the Center of Gravity of Planes; On Conoids and Spheroids; On Spirals; The Quadrature of the Parabola; The Arenarius; On Floating Bodies.*

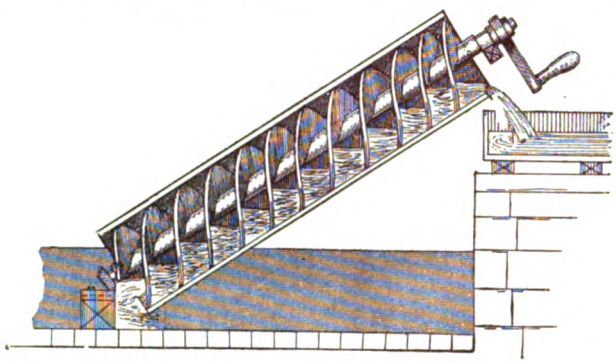
Archimedes. Molluscoid genus found in the carboniferous

limestone of N. America, the axis of whose polypidom is of a spiral form.



Archimedes lana.

Archimedes' Screw. Flexible tube bent spirally around a solid cylinder, turning on a longitudinal axis. This, when rotated in an inclined position with its lower end in a liquid,



Archimedes' Screw.

will raise the latter to a limited height. It is used in some countries for draining. The cut shows a metallic screw revolving in a box.

Archine. Russian measure of length, equal to 28 in.

Archinephric Duct. Segmental duct of the pronephros or "head kidney" of vertebrate embryos. It splits into a dorsal Wolffian duct and a ventral Müllerian duct. See SEGMENTAL DUCT.

Archinephros. Primitive kidney; differentiated into the pronephros, mesonephros, and metanephros, as development proceeds.

Archipelago. Group of islands. Patagonia furnishes an instance of border islands, the Aleutian islands of a chain, and the Grecian A. an example of grouped islands.

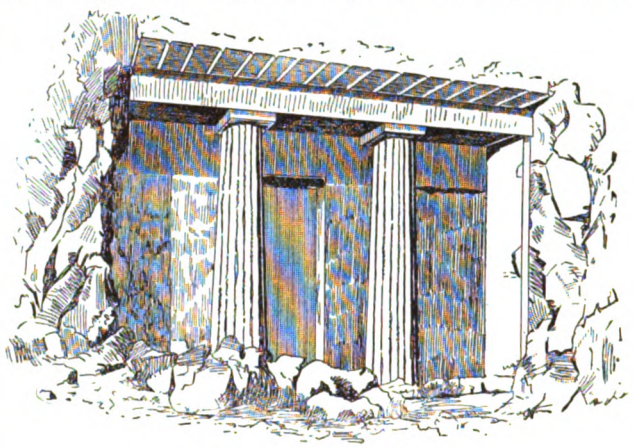
Archipterygium. Primitive fin, or limb, of vertebrates, composed of a jointed axis made of a succession of mesomeres, each of which bears a pair of lateral rays, the parameres.

Archispermæ. Plants usually known as *Gymnospermæ*.

Architecture. Art of building with reference to beauty or to expression as well as to use. The term, thus restricted, excludes constructions in which utility alone is sought. These belong, according to their importance, their durability, and the science exhibited in their erection, to building or to engineering. Architecture includes some dwellings and the edifices erected to express ideas, civic or religious, or to perpetuate the memory of men or of events. These last two classes of buildings comprise monumental architecture. Scarcely any race or nation above savagery has failed to contribute some durable reminder of its existence and some expression of its prevailing beliefs to the architecture of the world, the form of this contribution depending upon the nature of the idea sought to be expressed, the skill of the builders, and the materials and modes of construction available to them. While every race has left monuments, by far the most important line of architectural development, artistically as well as historically, began in Egypt ab. 3500 B.C. and is the main current of architectural history. For styles developed by it, or outside it, see ASSYRIAN, BYZANTINE, CHINESE, GOTHIC, GRECIAN, MAHOMETAN, RENAISSANCE, ROMAN, and ROMANESQUE ARCHITECTURE.

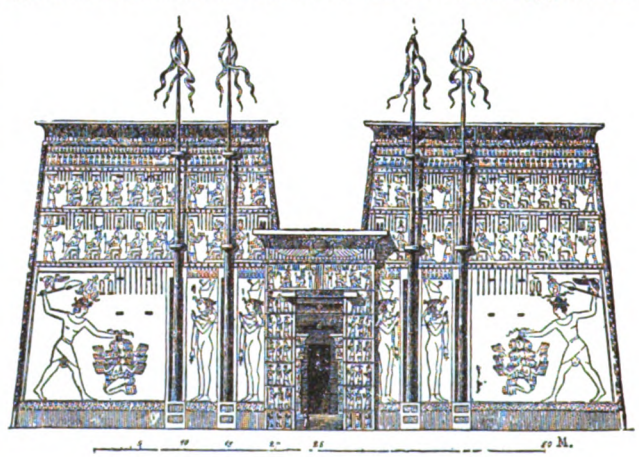
The earliest works of man that now remain, the Pyramids of Egypt, are purely monumental. Whatever scientific or other utility they may have had was incidental to their main purpose to preserve the memories of their builders. Their forms are simply those which promise the longest duration, and they are entirely without exterior ornament; but the exactitude and finish of the workmanship are not only wonderful, in view of their vast antiquity, but exceed the attainment, in these respects, of intervening or of modern times. The great pyramid of Cheops contains far more material than any other human erection (eighty-five million cubic ft. of stone). Other early Egyptian monuments are tombs, rock-cut, or otherwise excavated. They are mostly, like the pyramids, without ornament; but there is one remarkable tomb at Beni Hassan, which has a portico of two sixteen-sided and channeled columns *in antis*, the forms of which seem to prove the Egyptian origin of Grecian-Doric architecture. The Egyptian temples were remarkable, like the Pyramids, for their vast extent, massive structure, and admirable workmanship, but more elaborate in construction and elaborately decorated by means of color. The construction is that of the post and lintel, or upright and cross-beam, which has not since been employed on so extensive a scale, spans of over 30 ft. being bridged, in the Hypostyle Hall of Karnac, with single blocks of sandstone. The decoration is mainly pictorial, carved ornament being sparingly employed, and the modeling of structural parts limited to the shaping of the columns and of their capitals, which were in imitation of the buds or the blossoms of the lotus, and to large and simple moldings, concave and convex. All these temples are believed to have been erected during the 18th and 19th dynasties, 1820–1312 B.C.

That Grecian monumental architecture was derived from that of Egypt is no longer seriously disputed. The elements of



Tomb at Beni Hassan.

construction are the same, except the pediment, which is unknown in Egypt, the roof of which it is the expression being needless in a rainless climate. The Grecian builders took the Egyptian structural elements and so modified, rationalized, and elucidated their use as to produce monuments which, in purity, lucidity and refinement, have not been surpassed. It has been argued that the fundamental differences between Egyptian and

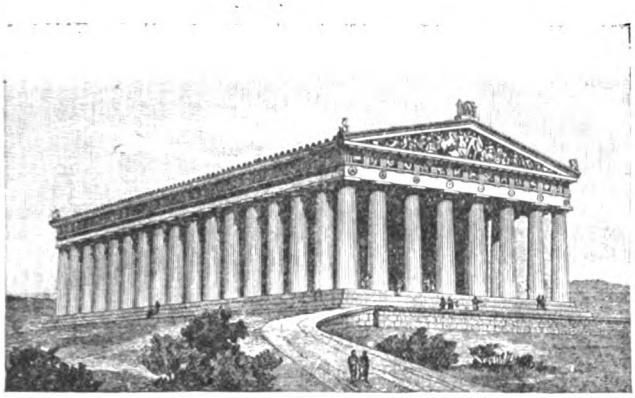


Temple at Edfu, Egypt.

Grecian architecture arise from the fact that the earliest Egyptian buildings were not properly constructions, but excavations, and that the forms and massiveness of design proper to excavations were retained in buildings that were erected and not excavated; whereas the design of the Grecian temples was in every respect suitable to actual constructions. Three orders resulted from the Grecian application of the Egyptian elements of construction; of each the most conspicuous badge is the form and decoration of the capital of the column, but in each minor differences are observable, modifying the entire work. An order properly includes the forms and proportions of the members of the portico, the inclosed cellar being merely faced with plain walls. The order prescribes not only the pro-

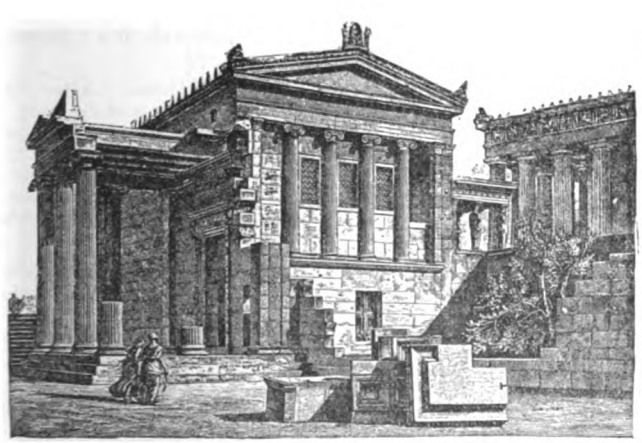
portion and form of the column, its capital and its base, but also the composition and proportion of the entablature supported by the column and the distance of the columns from each other. These details differed in the different orders, and also, within well-defined limits, in the same order.

The classification of the orders was made after Grecian architecture had ceased to be practiced, and is that of Vitruvius, ab. 14 B.C. The Grecian orders were the Doric, Ionic, and Corinthian. The occasional employment, notably in the Erechtheum at Athens, of representations of human figures, instead of columns, to support an entablature, has led some writers to add a



Parthenon, Athens, Restored (Greek Doric).

Caryatic order. The Parthenon at Athens, the most famous of Grecian buildings, is an octastyle (having eight columns in front), peripteral (entirely surrounded by columns) Doric temple. In the Doric order the stylobate (base) is continuous, each shaft resting directly upon it, without the intervention of a separate base; the columns are fluted, tapering slightly from the base, not regularly but with a slight outward curve (entasis), and four to six diameters in height. The capital consists of a necking (echinus), a convex curve (ovolo), and a straight-sided abacus. The entablature is subdivided into architrave, frieze and cornice, each of these members being subdivided. The frieze is a succession of triglyphs (upright members, each bearing two grooves), and metopes (square panels), the latter occupied by the sculptured and tinted reliefs that constitute the chief decoration of a Doric temple. Above the entablature at each end is the pediment, also occupied by a group of statuary. The Ionic order is supposed to have been derived from Asia, and Assyrian and Persian examples support this supposition, as respects its most distinguishing feature, the voluted capital. The Ionic order is more slenderly proportioned than the Doric, the column being, in the best examples, more than nine diameters in height, of which the molded base occupies $\frac{2}{3}$ of a diameter, and the capital, including the necking, $\frac{2}{3}$ to $\frac{4}{5}$. The entablature is subdivided as in the Doric order, but the frieze is continuous, the decoration being the richly carved moldings of the capital, architrave, and upper member of the cornice. Grecian Ionic

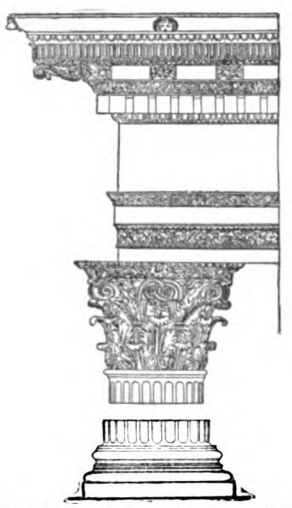


Erechtheum, Athens (Greek Ionic).

temples were seldom or never peripteral, being restricted to a portico at each end. The Corinthian order is doubtless of Grecian origin, its distinguishing mark being a capital much taller than that of either of the other orders, attaining commonly a height of $1\frac{1}{2}$ diameters, and decorated with the leaves of the acanthus conventionally designed and arranged. The column itself is ten diameters in height. The only complete example of the order in Greece is the choragic monument of Lysicrates at Athens.

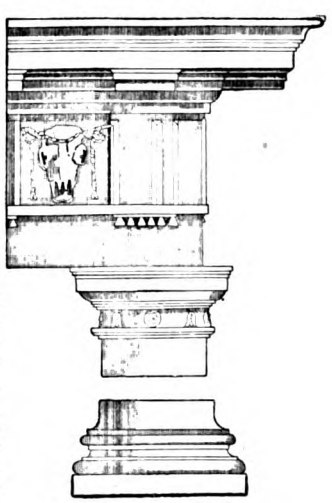
The Roman temples were imitated from those of the Greeks, and the imitation was in the main a debasement, tending to substitute an expression of luxury and magnificence for the more intellectual qualities of simplicity, purity and harmony of the originals. There is no completely developed Roman example of a Doric temple, and none of an Ionic temple that does not lose by comparison with the Greek. With the Corinthian order the case was somewhat different. As used in Greece, the elegance aimed at in this order degenerated into feebleness,

Monument of Lysicrates, Athens (Greek Corinthian).



Corinthian Order. From the Temple of Jupiter Stator.

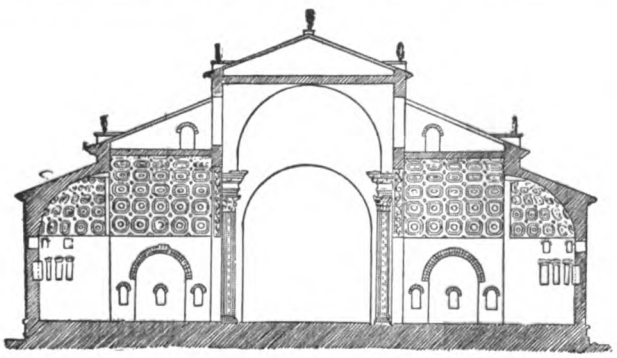
especially in the design of the capital. The Roman architects perceived this weakness and undertook to remedy it by developing the volutes at the angles, and confining the foliage more closely to the bell of the capital. These changes improved the capital as a structural member. The temple of Jupiter Stator in Rome is the best example. The volutes were finally developed into the proportions of an Ionic capital, being still set diagonally, and the foliage beneath retained. This modification is the distinguishing feature of the Composite, the fourth of the five orders recognized by Vitruvius, the fifth being the so-called Tuscan, a Roman modification of the Doric, commonly used on a much smaller scale, in which the column is not fluted, is provided with a separate base, and is crowned with a capital materially modified from the Greek Doric, though retaining its several members.



Roman Doric Order.

The arch was first extensively employed by the Romans as a constructive expedient, together with its derivatives, the dome, the half-dome, the wagon, or continuous vault, and the cross vault; but none of these structural features was developed, or made the basis of the design. Columns were employed, except in the temples, as decorative features, and applied to the faces of the piers, which were the real supports, the column never appearing in classical Roman architecture, except in part of the order, and in connection with an entablature, which, when used in connection with an arched construction, was not a continuous, horizontal member, but a fragment of a lintel, obviously performing no economical function. For this reason Roman architecture has been said to be transitional between the Grecian, in which the construction of post and lintel was the basis of the architecture, and the Romanesque, in which the arched construction served the same purpose. The epithet Classic is restricted to the works of the Greek and Roman builders, in which the Grecian orders were employed, and to modern works in imitation of these.

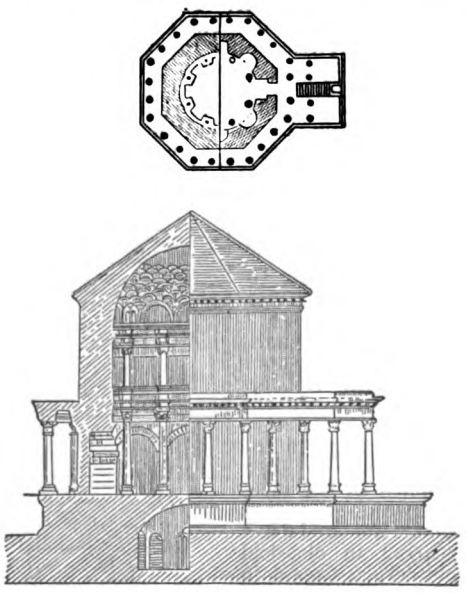
During the decline of the Empire and after its fall, the Roman methods of construction were adopted in all the countries in which the Romans had left monuments, and in these the influence of Roman building continued to be traceable throughout the whole of the Romanesque and Gothic periods, till 1400. The Basilica, a building of purely Roman type, is memorable as having furnished the type of the Christian church. It was a combined market-place, or merchants' exchange, and tribunal. It was a hall, its length twice to thrice its width, with a roof supported by columns; on each side of the colonnade was a lower building. The tribunal or court-room had a recess, often apsidal in plan, at one end, sometimes at each end, as in Trajan's at Rome, sometimes at one side, as in that of Fano, designed and described by Vitruvius. The basilicas were commonly of wood; our knowledge of them is derived from descriptions, from fragments of ground-plans preserved in tablets and from examinations, as that of Trajan and of Pompeii,



Transverse Section of Basilica of Maxentius.

the ruins of one of masonry, that of Maxentius, are still visible at Rome.

From these documents it is clear that the essential plan and arrangement of a church were comprised in the Roman basilica, including a nave and aisles, clerestory and apse. The effort of the Christian builders was to exemplify this type in more permanent materials, with roofs as durable as the walls, and to give appropriate and expressive forms to the vaulted construc-



Diocletian's Palace at Spalatro.

tion which they employed. Diocletian's palace at Spalatro, 305, is the earliest building in which the Roman arched construction was employed as the basis of the architecture, the arches resting directly upon the columns, the irrelevant entablature omitted, and the colonnade converted into an arcade.

This building is therefore said to be the beginning of Romanesque architecture, that of the column and the round arch, which prevailed throughout w. Europe for the ensuing seven centuries. The modern architecture of e. Europe and of Asia is not less derived from Roman sources. The builders of Byzantium applied to the Roman dome, as exemplified in the Pantheon, the same rationalizing process which the early Romanesque builders applied to the wall-arch. The St. Sophia, in Constantinople, 532–537, is as clearly the earliest example of Byzantine building as the palace of Diocletian of w. Romanesque. In this is found the origin of the domed architecture of Mahometan countries, of the mosques of Spain, Egypt, Persia and India, as well as of the Greek Church architecture, including that of Russia. On the Italian shore of the Adriatic the style derived from Rome through Constantinople was practiced together with that derived directly from Rome. St. Mark's at Venice, consecrated 1085, and San Vitale at Ravenna, 530, are distinctly Byzantine buildings, and the style penetrated as far as Perigneux (St. Front, 1047) and even to Aix-la-Chapelle (Charlemagne's chapel, 796–804). These domed churches are exceptional; the Roman basilica remained the church type throughout western Europe. The desire for a durable roof of masonry was the motive of the development of Romanesque architecture. The mechanical difficulty of bridging wide spaces with masonry is illustrated in some Romanesque churches by the fact that while the aisles were roofed with groined vaulting, the wider naves were covered with continuous wagon-vaults, as with roofs and ceilings of timber. The difficulty and awkwardness of uniting semi-circular arches of different spans and heights led to the introduction, in France, ab. 1150, of the pointed arch, which had been employed by the Arabian builders in Egypt, three centuries earlier. The application of this device made comparatively easy a more complicated system of vaulting than had before been possible. Within less than a century after its first appearance the vault-and-buttress system of the cathedrals was fully developed, while a system of modeling, with reference to the expression of function, had been extended to all the details of buildings. Gothic architecture prevailed throughout Europe during the 13th and 14th centuries. During the 15th the revival of letters in Italy led to a diligent study of the forms of classical architecture, and the result was the so-called Renaissance, in which these forms were again introduced. The only new structural form then introduced was a cupola, much taller in proportion to its diameter than that employed by the Roman or Byzantine builders. The first example of this was furnished by Brunelleschi in the dome of the cathedral of Florence, 1420–44; it was followed by Alberti, Bramante, and Michelangelo (in St. Peter's at Rome), in which the dome was the dominating feature of the building, both within and without. Architectural details were borrowed or compiled from classical Roman architecture. The style thus formed has continued to prevail throughout Europe. In France, some parts of Germany, Great Britain, and America, churches are often designed in Romanesque or Gothic forms; and in these countries, especially in England, Germany, and the U. S., systematic efforts have been made, within the past half century, to revive mediæval architecture, and to apply its principles to secular as well as to ecclesiastical structures. In spite of these efforts, the Renaissance continues to be the architectural style most in vogue with all civilized nations.

Architrave. In classic architecture, the lowest member of the entablature, a beam resting directly upon the abaci of the capitals. In Grecian Doric it is quite plain and composed of a single course of stone. In Ionic and Corinthian it is composed of three courses, with well-defined joints, but otherwise without ornament. In Roman the joints are often enriched with decorated moldings.

Archivolt. Molding on the face of an arch and following its curve.

Archons. Highest magistrates at Athens. After the abolition of the regal office an archon for life was elected; in time the term was made ten years; in 684 B.C. it became annual, and the office was shared by nine colleagues, who divided the several functions. One presided, after whom the year was named, another directed religious rites, and yet another commanded the army. During a long period they were selected by lot from among the wealthier citizens.

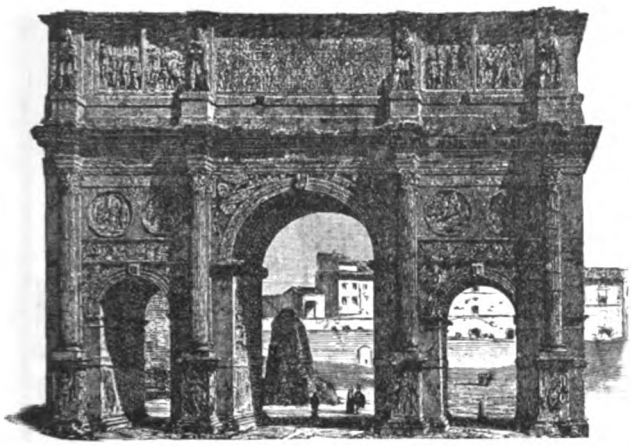
Archosauria. Division of *Reptilia* including the orders: *Anomodontia*, *Crocodilia*, *Ornithoscelida*, and *Ornithosauria*. In these forms two post-orbital bars are present, united to quadrate bone by suture. Also, a group of fossil Reptiles, including the *Theriomorpha*, *Dinosauria*, and *Ornithosauria*.

Archpresbyter, or ARCHPRIEST. Order once next to bishop, powerful till 12th century; now resembling, in Greek Ch., Anglican deans, and in R. C., rural deans.

Arch Roof. One having curved trusses without visible tie rods, so that the walls of the building are apparently subject to a lateral thrust. A groined roof is formed of two arched passages intersecting at right angles. The roof of the machinery hall of the Paris Exposition of 1889 had a central arch of

364 ft. span, and that of the Liberal Arts building of the Chicago Exposition of 1893 a central span of 368 ft., the largest arch roof ever built.

Arch, TRIUMPHAL. Originating with the Romans; built across roads, or at the entrance to cities, in honor of successful generals and foreign conquests. In Rome, those of Drusus, Titus, Septimus Severus and Constantine are notable; the latter built of materials from an arch of Trajan, destroyed for



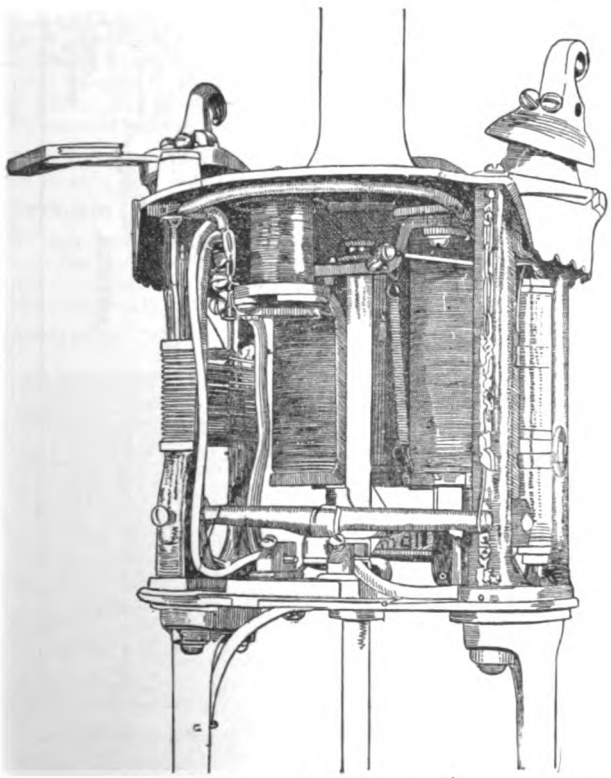
Triumphal Arch of Constantine.

the purpose. There are fine specimens at Beneventum and Aosta, and several in France.

Archytas, d. ab. 350 B.C. General of Tarentum, Pythagorean philosopher, supposed friend of Plato and Aristotle, eminent mechanician. Fragments of his writings remain.

Arcifera. Order of *Anura*, forms having the breastbone soft and cartilaginous; including the *Bufonidæ* (Toads); the *Discoglossidæ*, e. g., *Alytes; Cystignathidæ*, e. g., *Hylodes; Pelobatidæ*, represented by *Scaphiopus;* and the *Hylidæ* or Tree Frogs.

Arc Lamp. The method first devised for producing the electric light consisted in bringing the carbon terminals of a sufficiently powerful generator into contact and then separating



Brush Arc Lamp.

them. The current continues to flow across the gap, developing, in consequence of the great resistance there, a most intense heat, which raises the terminals to vivid incandescence. If the carbons be horizontal, the upward current of air causes the luminous stream to assume an arched form; whence the name "electric arc." The electric arc lamp is a device for holding the carbons of an arc light and for maintaining the light constant by means of suitable mechanism. The latter function it is which has given the name "regulator" to such lamps. Two distinct operations must be performed by the regulator; first, it must separate the carbons to produce the light; and second, it must feed these carbons forward as fast as they are consumed, so as to preserve the light from extinction and to keep the length of the arc constant. It may be also necessary, as in the case of focusing lamps, for the regulator to perform a third function; viz., that of keeping the arc constant in position. Moreover, lamps must be capable of operating independently, so as to be used in a circuit with others without being effected by their variations.

In commercial lighting, lamps are usually arranged in series, and the Brush lamp may well serve as a type of this class. In this a ring clutch, surrounding the upper carbon holder, and controlled by an electro-magnet in series with the carbons, lifts this holder as soon as the current passes, and thus separates the carbons and produces the light. Moreover, this magnet is antagonized by a second one in shunt circuit with it, for the purposes of regulation; since, whenever the arc becomes too long and is in danger of extinction, the increased resistance thus developed throws more current into the antagonizing shunt magnet, enabling it to overcome the main magnet and so to allow the carbons to feed together. Since the result is due to the differential action of two magnets, one situated in the main and the other in the shunt circuit, such lamps are generally known as shunt differential lamps.

As the positive carbon burns away about twice as rapidly as the negative one, an additional device must be applied in focusing lamps to feed the former twice as fast as the latter. Of arc lamps those used for search-lights are the most powerful. For this purpose the arc is placed in the focus of a parabolic mirror.

Arc of Contact. In toothed gearing, the arc of the pitch circle which passes any fixed point during the driving contact of two teeth. It should never be less than the distance between the centers of two teeth (the circular pitch of the wheel), or else the driver would cease acting on one tooth before the next tooth was engaged; hence a jump and shock would occur over the space where the driver met no resistance. The arc of contact is usually $1\frac{2}{10}$ or twice the circular pitch, and is limited by the condition of not having excessive length to the teeth outside the pitch circle, which would cause unusual obliquity of action of the teeth, and produce greater friction.

Arcola. Town of Lombardy, site of three battles, Nov. 14–17, 1796, between Bonaparte and the Austrians under Alvinzy, who lost 18,000 men. The French lost 15,000 and became masters of Italy.

Arcot, or ARKAT. City of s. Hindustan, 65 m. s. w. of Madras. Its capture by Clive, Aug. 1751, was the beginning of British power in India. It is the chief town of two districts of the Madras presidency, n. and s. Arcot, which have an area of ab. 12,100 sq. m., and a pop. of ab. 3,700,000.

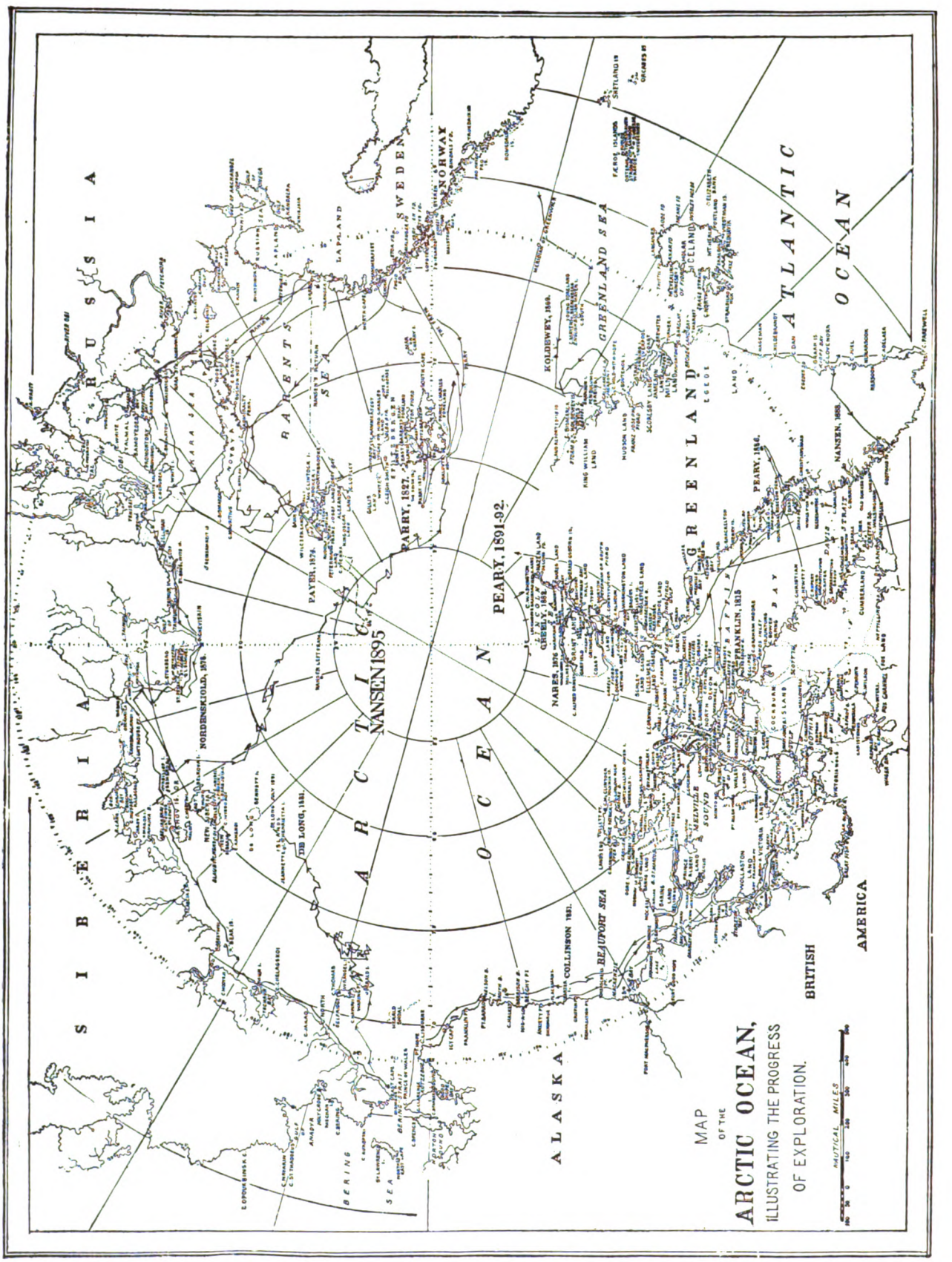
Arctic Ocean. That part of the sea lying n. of Asia and N. America, and surrounding the N. Pole. It communicates with the Pacific through Behring Strait, with the Atlantic through Smith Sound and the broad passage between Greenland and the Scandinavian peninsula. It contains numerous islands, many of them very large, as Nova Zembla, Spitzbergen, New Siberia, and Wrangle Land, besides the great archipelago n. of N. America. Its shores are icebound. Many navigators have explored it to find the N. W. Passage. Parry reached lat. 82° 45′ N. in 1827; Kane attained lat. 81° 22′ in 1854, and found reason to infer an open sea around the pole; Lockwood of Greeley's expedition, 1882, reached 83° 24′, which is the highest point thus far attained. There are floating masses of ice 200 ft. in height, and ice-fields 100 m. in length. Capt. Ross measured a berg which rose 325 ft. above the water. (See Map, page 88.)

Arctinus. Probably 7th cent. B.C. Greatest of the Cyclic Greek poets. The epics *Æthiopis* and *Destruction of Troy* were attributed to him: another is also ascribed to him by some. We have a synopsis of these, and fragments.

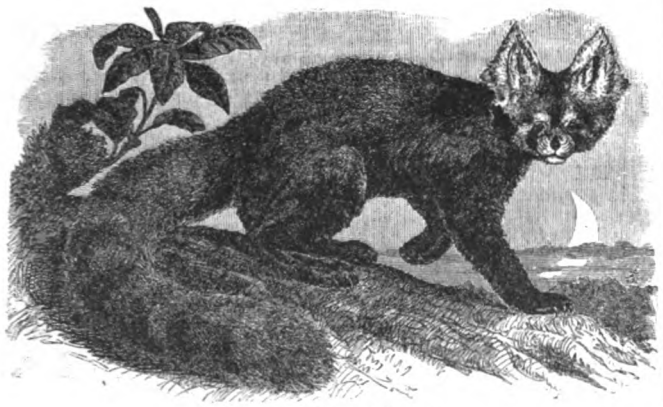
Arctisca. See TARDIGRADA.

Arctogæa. Division of the earth's surface, used in considering biological distribution; comprising the Eurasian continent, the Indian and Ethiopic regions, and N. America. This region was as distinctly characterized by its fauna in Tertiary times as now.

Arctoidea (PLANTIGRADA). Section of *Carnivora Fissi-*


MAP
OF THE
ARCTIC OCEAN,
ILLUSTRATING THE PROGRESS
OF EXPLORATION.
NAUTICAL MILES
SIBERIA
RUSSIA
ALASKA
GREENLAND
ATLANTIC OCEAN
ARCTIC OCEAN
NANSEN 1895
PEARY, 1891-92.
PARRY, 1827.
PAYER, 1874.
NORDENSKIOLD, 1878.
DE LONG, 1881.
COLLINSON 1851.
NARES, 1876.
KOLDEWEY, 1869.
PEARY, 1886.
NANSEN, 1888.
FRANKLIN, 1815.
BRITISH AMERICA
GREENLAND SEA
BARENTS SEA
BERING SEA
BEAUFORT SEA
MELVILLE SOUND
SWEDEN
NORWAY
LAPLAND
ICELAND
SHETLAND IS
FAEROE ISLANDS
ORCHARD IS
KING WILLIAM LAND
HUDSON LAND
SCORESBY LAND
EGEDE LAND
COCKBURN ISLAND
CUMBERLAND
DAVIS STRAIT
BAFFIN BAY
LINCOLN SEA
GREELY, 1882
ANADYR
NORTH CAPE
BERING STRAIT
ANADYR
BERING SEA
ALASKA
BRITISH AMERICA

pedia, including the families *Ursidæ* (Bears), *Procyonidæ* (Raccoons), *Æluridæ* (Panda of India and Thibet), and *Mustelidæ* (Weasels, etc.).



Panda (*Ælurus fulgens*).

Arctomyinæ (GROUND SQUIRRELS). Sub-family of *Sciuridæ*, including the *Arctomys* (Marmots), *Cynomys* (Prairie-dog), *Spermophilus* (Ground Squirrels), and *Tamias* (Chipmunk).

Arctomys. The Marmot, Woodchuck, or Ground-hog is the largest member of the Squirrel Family (*Sciuridæ*). See ARCTOMYINÆ. They measure up to two feet in length, are plump, have a short bushy tail, low ears, and coarse hair. Cheek pouches are rudimentary, and the pollex bears a flat nail. *A. monax* is the woodchuck proper, which lives solitarily, hibernates in winter, and comes out in spring, whence its use as a weather prophet. Marmots like prairie-dogs generally live in colonies.

Arctopithecini, or HAPALIDÆ. Group of *Simiadæ*, including the Marmosets. The nose is of the platyrhine type; the pelage soft and abundant; the tail is long, bushy, and nonprehensile. There are no cheek pouches or natal callosities; the fore-limbs are shorter than the hind. There is no opposable thumb, and the digits are all clawed except the opposable hallux, which has a flat nail. The number of teeth is the same as in man, but there is a præmolar more and a molar less in each series. The molar teeth have pointed cusps. They are S. American monkeys, about as large as squirrels; several species are domesticated and kept as pets. The coloration is variable; many have bands on the tails, and some (*Midas*) have peculiar crests of hair and whiskers. They are not hardy. The female usually bears twins or triplets after but three months' gestation. The cerebral hemispheres cover the cerebellum. They require insects as food.

Arcturus = α BOOTES. Star of first magnitude. Right ascension 14h. 10m. 36s. Declination 19° 45′ 38″ N.

Arcuata. See CRABS.

Arcus Senilis. White ring which forms around the margin of the cornea after middle life; occasionally seen in those much younger. It is of little importance except when it extends sufficiently to obscure the central portion of the cornea.

Ardeidæ. *Herodii*, especially *Ardea* (Herons), *Botaurus* (Bitterns), and *Cochlearius* (Boatbills), which have respectively three, two, and four pairs of powder-down patches. The bill is ungrooved, and the hind toe is at the same level as the others. This enables many species to nest in trees, or to grasp reeds among which they live.

White Garzette (*Ardea garzetta*).

Arditi, LUIGI, b. 1822. Italian composer and opera conductor in London and America; author of a waltz *Il Bacio*, and the operas *I Briganti*, 1841; *Il Corsaro*, 1846; *La Spia*, 1856.

Are. Metric unit of Surface; a square whose side is ten meters.

Area. Limited surface considered as subject to measurement. Algebraic expressions for area contain two linear factors. Similar areas are to each other as the squares of homologous elements.

Area Germinativa, or EMBRYONIC AREA. Part of the surface of large eggs, upon which the embryo lies. Small eggs are practically the whole embryo.

Area of High Pressure. Region over which barometric pressure is higher than in the neighboring regions. On meteorological charts and reports these areas are for brevity frequently designated as "High." Special local high areas occupy the continents in the cold seasons, and by connecting ridges produce a belt of average high pressure around the globe.

Area of Low Pressure. Any region, usually oval or circular, over which barometric pressure is lower than in the neighboring regions. A large region of this sort occupies the Antarctic circle; smaller regions, frequently called "Lows," occupy the central portion of storms and all cyclonic systems of winds.

Areca Palm. See BETEL-NUT.

Arena. Sandy space inclosed by the AMPHITHEATER (q.v.).

Arenal Measure of an Angle. Sometimes called "$_{\pi}$" measure. An angle may be measured by the ratio of the intercepted arc (having center at the angular vertex) to its radius. The unit, called Radian, is the arc equal in length to the radius, and equals in degree measure 57° 17′ 44.80″ +. In this measure

$$180^\circ = \pi : 90^\circ = \frac{\pi}{2}\ 60^\circ = \frac{\pi}{3}\ 1^\circ = \frac{\pi}{180^\circ} = 0.01745+.$$

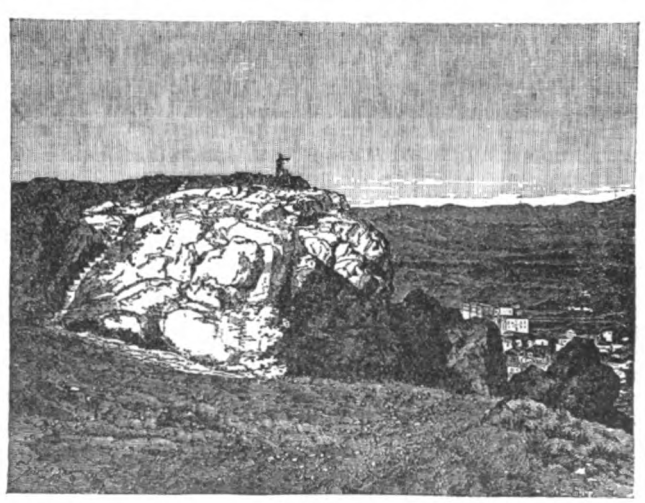
Arenicola. A tubicolous Annelid, with small præstomium, without tentacles. The proboscis is beset with papillæ, or branched gills on the posterior segments. They burrow in the sand.

Areolar Tissue. Connective tissue or interlacing network of fine fibers which cements together the elements of the organs and tissues, and loosely joins structures which adjoin each other; *e.g.*, the skin and the muscles beneath it.

Areolation. Reticulated areas of leaves; especially in ferns and mosses, and the markings on diatoms.

Areometer. Instrument for measuring the rarity or density of a liquid. See HYDROMETER.

Areopagus. Hill of Ares or Mars, w. of the Acropolis in Athens; hence the most ancient court of Athens, which met there. Solon changed its constitution; it became less aristocratic and received the nine annual archons as new members.



Areopagus.

after they had completed their year of office. Its original jurisdiction was principally in cases of murder, but it was now empowered to exercise a general supervision of morals. Its power suffered by the democratic development of the Athenian constitution, but its influence and high repute endured for several centuries. Here St. Paul preached; Acts xvii. 19–31.

Arequipa. (1) City of Peru, in the valley of the Chile, 7,775 ft. above sea. Pop. ab. 30,000. (2) Peak of the Andes, near the city; ht. 20,320 ft.

Ares. Greek god of war. See MARS.

Areschoug, FREDERICH WILHELM CHRISTIAN, b. 1830. Swedish botanist, prof. Lund. *Skanes Flora*, 1866.

Aretæus, ab. 60–ab. 130. Physician of Cappadocia, author of a work, yet extant, on diseases.

Aretas. Arabian king who controlled Damascus at the time of St. Paul's conversion, and, to please the Jews, endeavored to arrest him, II. Cor. xi. 32.

Arethusa. Nereid, presiding over a fountain in the island Ortygia. See ALPHEUS.

Arethusa. Orchid, native in swampy and boggy ground in e. N. America.

Aretino, PIETRO, 1492–1556. Italian author, noted for his satires and loose comedies; called "the scourge of princes."

Aretinus, LEONARDO BRUNI, 1369–1444; chancellor of Florence 1427; tr. of Greek classics into Latin.

Arezzo. Ancient *Arretium*, one of the twelve confederate Etruscan cities, Roman after 310 B.C. Birthplace of Mæcenas, Guido and Pietro Aretino, Petrarch, Niccolo d'Arezzo, and Vasari. Important churches: San Francesco (1322), Santa Maria della Pieve, and the Cathedral. Pop. 12,000.

Arezzo, NICCOLO D'. Italian sculptor, active after 1388; one of the earliest forerunners of the Renaissance. Indications of the dawning style are seen in his decorative designs on the second n. door of the Florentine cathedral.

Arfvedson, JOHAN AUGUSTE, 1792–1841. Swedish chemist, who discovered the metal Lithium 1817.

Argæus, MT. In Cappadocia; greatest elevation in Asia Minor; depicted on many Græco-Roman coins. Ht. 13,100 ft.

Argand, AIME, 1755–1803. Swiss chemist and physician; lamp-maker in Paris.

Argand Lamp. Invention of Dr. Aimé Argand, 1782, to effect complete combustion. The German student-lamp and Rochester burner are familiar illustrations of its principles, which consist of an annular flame admitting air to center of the flame, and a chimney to steady the light.

Argelander, FRIEDRICH WILHELM AUGUST, 1799–1875. German astronomer; at Abo 1823–32, at Helsingfors 1832–37, prof. at Bonn from 1837; a very accurate and industrious observer, author of profound researches on proper motions of stars, motion of the sun in space, and many other subjects.

Argens, JEAN BAPTISTE DE BOYER, MARQUIS D', 1704–1771. French author, long resident in Berlin. *Jewish Letters*, 6 vols., 1738–42; *History of the Human Spirit*, 14 vols., 1765–68.

Argensola, LUPERCIO LEONARDO D', 1559–1613. Spanish lyric and dramatic poet.—His brother, BARTOLOME LEONARDO, 1562–1631, was also a poet, and wrote *Conquest of the Moluccas*, 1609.

Argentan. See GERMAN SILVER.

Argentic Salts. See SILVER SALTS.

Argentine Republic. State of S. America, including the s. part of the continent e. of the summit of the Andes. Its area is 1,200,000 sq. m. The w. part consists of the Andes with their foothills; the remainder of broad plains, partially timbered in the north, becoming more arid and grass-covered in the middle (the pampas region) and sterile in the s. portion, or what was formerly Patagonia. The most important industry is the raising of cattle and sheep, and the principal commerce is in their products. Railroad building is very active; in 1892 there were ab. 7,000 miles in operation. The capital is Buenos Ayres, on the La Plata, founded 1535, pop. 550,000. Other important cities are Cordova, Rosario, and La Plata. Pop. ab. 3,500,000, including nearly 600,000 of European birth.

The region about the mouth of the Rio de la Plata was first explored 1512. The country was dependent on the Government of Paraguay till 1620, when Buenos Ayres became the seat of government, but still subject to the vice-royalty of Peru. In 1809–10 the people renounced their allegiance to Spain, and in 1813 a Congress was assembled at Buenos Ayres, with Povadas as dictator. In 1825 a Constitution was adopted and a federation formed. A war with Brazil for the possession of the region lying between the two resulted in a treaty, 1828, by which Uruguay became independent. Other wars ended, 1852, in Rosas' defeat and the independence of Paraguay. A financial crisis in 1890–91, with the repudiation of the public debt, caused the failure of Baring Bros. in London and heavy losses in Europe.

Argentite. Ag_2S. One of the most valuable of the silver ores, containing 87 per cent of silver and 13 per cent of sulphur; found in many of the best known silver mining regions of the world.

Argillite. Lithological name for clay slate.

Arginusæ. Three small islands s. e. from Lesbos, famous for naval victory of Athenians over Lacedemonians 406 B.C.

Argives. People of ancient Argolis.

Argo. Ship in which Jason, Hercules, Theseus, Castor and Pollux, with 45 other heroes, called Argonauts, sailed to Aea (Colchis) to fetch the Golden Fleece. Athena superintended its building. California gold miners, 1849, were called Argonauts.

Argo. Southern constellation. Mean right ascension 8h; mean declination 50°.

Argol. Crude cream of tartar, potassium bitartrate, formed in interior of wine casks.

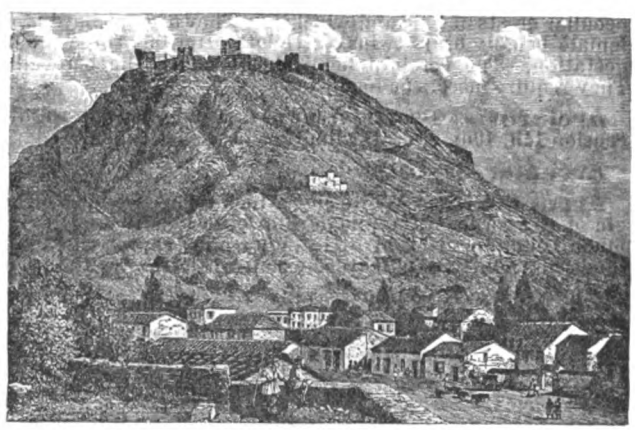
Argolis. Ancient state of n. e. Peloponnesus, ruled by Agamemnon at time of Trojan war. Argos was its capital, and Mycenæ one of the chief cities.

Argon. At. wt. 20. Sp. gr. 0.138. liq.—121° C. 50.6 Atm. Solid—191° C. Absorption spectrum differs from all others. Constituent of the atmosphere, discovered, 1894, by Lord Rayleigh, by passing air, freed from moisture, carbon dioxide and oxygen, over heated magnesium turnings leaving $\frac{1}{120}$ volume of Argon. Chemically it is very inert. Facts yet obtained do not warrant a final decision as to its elemental nature.

Argonauta. See DIBRANCHIATA.

Argonauts. See ARGO.

Argos. Capital of Argolis, famous for worship of Hera (Juno). It emerges in history ab. 750 B. C. as chief state in the peninsula; frequently at war with Sparta; joined Achæan



Argos.

League 243, and in 146 B.C. became part of the Roman province of Achaia.

Argot. Slang of thieves in various countries.

Arguelles, AUGUSTIN. 1776–1844. Spanish liberal, eminent for eloquence and consistency; imprisoned 1814–20, exiled 1823–32; tutor to Isabella 1841.

Argument, or ARGUMENTATION. Process of proof; expressing the ratiocinative as opposed to the intuitive mode of obtaining knowledge. *Argumentum ad hominem* is appeal to personal conditions or opinions; *A. baculinum* is club-law.

Argument. In mathematics, a quantity upon which another depends, thus the refraction varies with the altitude, the attitude is then the argument in finding the refraction.

Argument of an Imaginary. The base angle of the right triangle of which the sides are the reals of the normal imaginary and the hypothenuse the *modulus*.

$$a+b\sqrt{-1}=M(\text{Sin }\phi+\text{Cos }\phi\sqrt{-1}$$

$M=\sqrt{a^2+b^2}$ is the modulus. ϕ is the argument.

Argus. In mythology, he had 100 eyes. Juno set him to guard Io after she was changed to a cow; Hermes put him to sleep by the tones of his flute, and cut off his head. Juno placed his eyes in the tail of the peacock.

Argus. Genus of birds, *Gallinæ phasianidæ*. The wings are marked by iridescent eye-like rings. Asiatic.

Argus-Pheasant.

Argyle, ARCHIBALD CAMPBELL, MARQUIS OF, 1598–1661. At first a leader of the Scottish Covenanters, he was defeated by Montrose 1644; sided with Charles II. against Cromwell 1657; was beheaded for submission to the Protector May 27, 1661.—His son and namesake, 9th earl (1663), was condemned 1681 for taking the test-oath with a reservation, escaped, took part in Monmouth's rebellion, and was beheaded June 30, 1685.

Argyle, GEORGE JOHN DOUGLAS CAMPBELL, 8TH DUKE OF (1847), b. 1823. Scottish statesman and author; Sec. for India 1868–74 and 1880–81. *Presbytery*, 1848; *Reign of Law*, 1866; *Primeval Man*, 1869.

Argyropulos, JOHANNES, 1416–1473. Greek teacher in Italy; tr. Aristotle.

Arhagea. Group of Nemertean worms, having no ciliated grooves on the head. It includes the *Palæonemertea* and *Haplonemertea*.

Arhan. Sanskrit name of the perfected Arya, those who have mastered the four spiritual truths and thereby entered the path to Nirvana. Also applied to all the disciples of Sakyamuni. The Chinese Buddhists apply it especially to the famous 18 and 500 disciples whom they call *Lo-hân*.

Ari, "THE WISE," 1067–1148. Icelandic historian. His *Book of Kings* and *Icelanders* exist only in fragments; the *Settlements* is his in part.

Aria. Musical composition for solo voice or instrument with accompaniment, consisting generally of three divisions, the third being a repetition of the first. It had its origin ab. 1650, and in the operatic form of the 18th century was thus classified: *Aria cantabile*, a flowing melody lightly accompanied; *Aria di portamento*, in a sustained style; *Aria di mezzo carattere*, more fully developed and embellished; *Aria parlante*, *Aria di nota e parola*, *Aria agitato*, *Aria di strepito*, or *Aria infuriata*, charged with more passionate emotion; *Aria di bravura*, or *Aria d'agilità*, florid and designed to display the singer's skill.

Ariadne. Daughter of Minos, King of Crete. She fell in love with Theseus and gave him the clew by which he found his way out of the Labyrinth; accompanied him on his return to Athens, but was deserted by him in Naxos, and became the wife of Dionysus.

Arianism. Movement proceeding from ARIUS (q.v.), intended to make the mystery of the Trinity plainer. It declared the Son to have proceeded not from the Being but from the Will of God, and to be of different substance both from the Father and the World, which God created through Him. Condemned by the First General Council, at Nicæa, 325, it died very slowly in the Empire, and much more slowly among the Teutonic tribes, some of which, especially the Visigoths of Spain, held it almost to 600, and the Lombards till toward 700.

Arias Montanus, BENEDICTUS, 1527–1598. Spanish Benedictine monk, editor of the Antwerp Polyglot Bible, 1568–72; famous as an Orientalist.

Aries. See ZODIAC.

Arietta. Diminutive of Aria.

Aril. Accessory seed-covering found in certain plants, as in the white water-lily; formed by growth of a membrane at or near the base of the ovule after fertilization.

Arillode. Accessory seed-covering resembling an aril, but developing from the apex of the ovule downward, as in Mace.

Ariobarzanes. (1) Three kings of Pontus. One of them revolted from Artaxerxes 362 B.C., reigned 363–337, and may be regarded as the founder of kingdom of Pontus. (2) Three kings of Cappadocia. One reigned 93–63 B.C. under the Romans. His grandson ruled 51–42, and aided Pompey against Cæsar.

Arion, 7th century B.C. Poet of Lesbos; inventor of dithyrambic verse. His life being threatened by sailors, he invoked the gods, threw himself into the sea, and was borne to land by a song-loving dolphin. This legend is depicted on many Greek coins.

Ariosto, LODOVICO, 1474–1533. Italian poet, made famous by his epic *Orlando Furioso*, 1516–32. He wrote also comedies, satires, and sonnets.

Ariovistus. Leader of German tribes who invaded Gaul ab. 72 B.C.; defeated by Cæsar 58 B.C.

Arista, MARIANO, 1802–1855. Mexican general, defeated at Palo Alto 1846; pres. of Mexico 1850–53.

Aristænetus, ab. 500. Greek letter-writer.

Aristæus. Son of Apollo, protector of vineyards, herds, and beehives.

Aristarchus, ab. 222–150 B.C. Most famous of Greek critics and grammarians, b. at Samothrace. He studied at Alexandria, was tutor to Ptolemy Epiphanes and Ptolemy Physcon, head of a grammatical school there, and devoted his life to the criticism and interpretation of Greek authors. His text of Homer is the basis of ours. When Physcon maltreated the Alexandrian scholars, he fled to Cyprus, where he committed suicide. He opposed the school of Pergamus, led by Crates of Mallus. He is often mentioned in the Venetian scholia to Homer, though no genuine works have survived.

Aristarchus, OF SAMOS. Astronomer at Alexandria 280–264 B.C. Author of a work on the magnitudes and distances of the sun and moon; said to have been the first to maintain the doctrine, afterward established by Copernicus, that the earth moves round the sun, though Pythagoras is believed to have taught something of this kind secretly.

Aristeas. Mythical person said to have been sent ab. 273 B.C. by Ptolemy Philadelphus to Jerusalem to obtain a copy of the Hebrew Scriptures and procure men to translate it into Greek. In the legend he brought 70 elders, who in 72 days made the version called the Septuagint.

Aristeides, d. 467 B.C. Athenian, called "the Just." He fought at Marathon 490 B.C.; archon 489; ostracized through influence of his rival Themistocles 482; aided the Greeks at Salamis 480; was recalled, and commanded the Athenians at Platæa 479.

Aristeides. Alleged inventor of Greek romance; date and place unknown.

Aristeides, P. AELIUS, ab. 117–185. Of Smyrna; best orator of his time; 55 orations and 2 minor treatises remain.

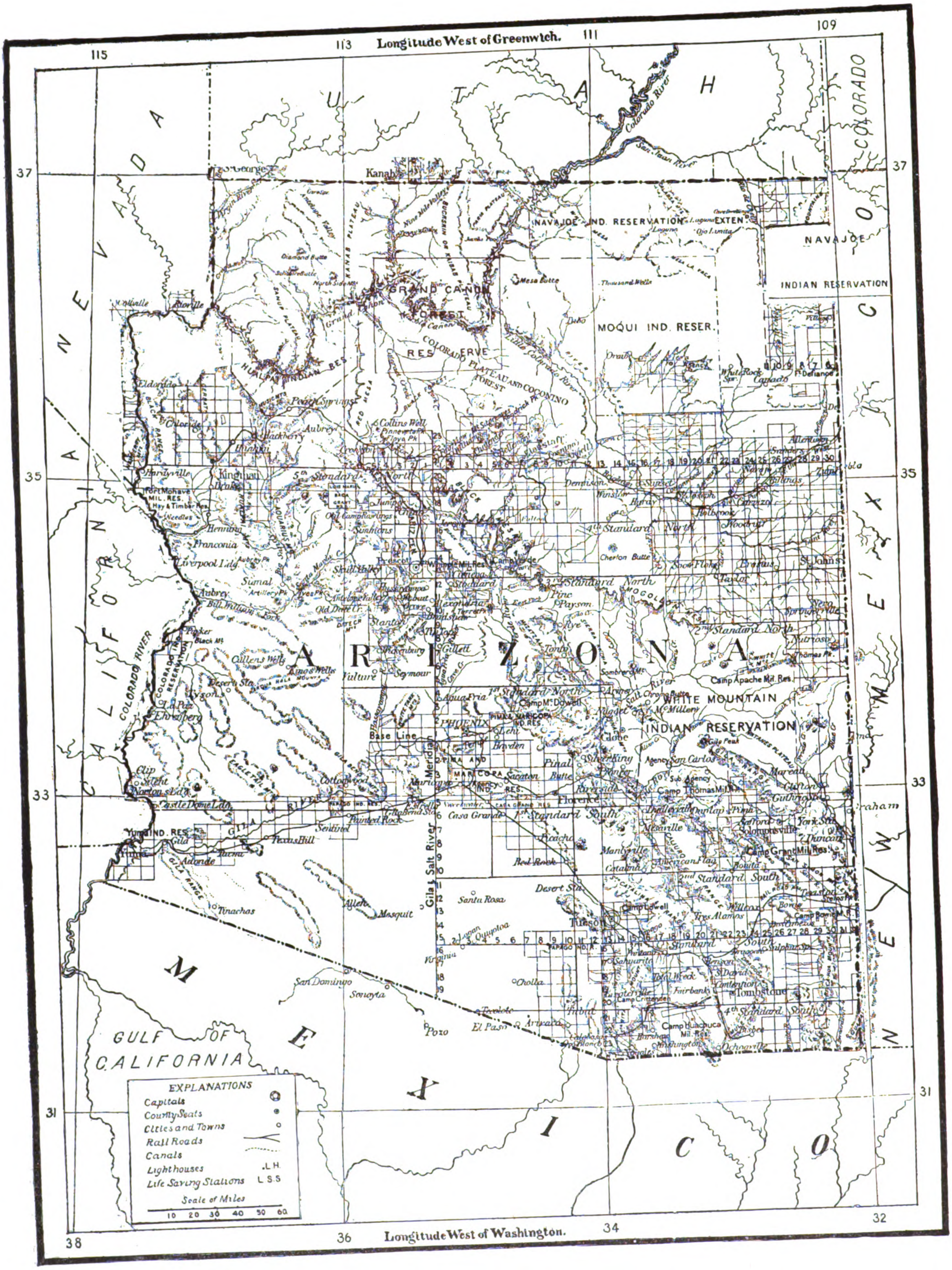
Aristeides, QUINTILIANUS. Greek writer of unknown date, whose work on music is extant.

Aristippus, ab. 435–ab.326 B.C. Greek philosopher, founder of the Cyrenaic school; pupil, but scarcely disciple, of Socrates. He taught that pleasure is the end of life, but must be attained by prudence.

Aristo. Stoic teacher at Athens 3d century B.C.

Aristobulus. Name of several eminent Jews. I. Alexandrian teacher and writer ab. 160 B.C. II. High-priest, son of John Hyrcanus; king 107–105 B.C. III. Son of Alexander Jannæus; king ab. 70–63 B.C., then a Roman captive and officer, d. ab. 48 B.C. IV. Son and victim of Herod the Great. V. Son of the last, residing privately at Rome. VI. King of Armenia and Chalcis, 55–62.—Also, a Greek historian of Alexander's conquests.

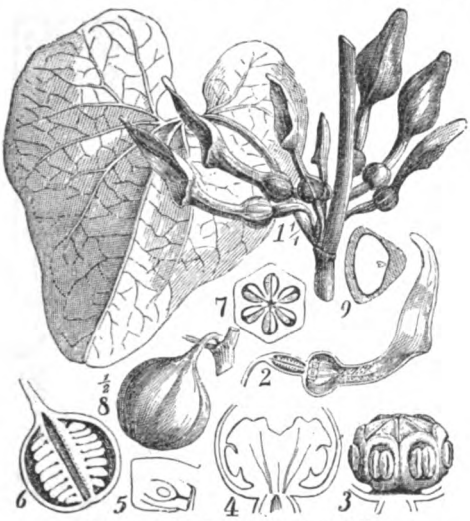
Aristocracy. Class of people holding prescriptive rights; literally, the rule of the best; second stage in the Aristotelian analysis of government of the One, of the Few, and of the Many. Social evolution indicates the steady decrease of the


Longitude West of Greenwich.
115
113
111
109
37
35
33
31
U T A H
N E V A D A
C A L I F O R N I A
COLORADO
N E W M E X I C O
A R I Z O N A
M E X I C O
GULF OF CALIFORNIA
Colorado River
San Juan River
COLORADO RIVER
GRAND CANON
NAVAJOE IND. RESERVATION EXTEN.
NAVAJOE INDIAN RESERVATION
MOQUI IND. RESER.
WHITE MOUNTAIN INDIAN RESERVATION
COLORADO RESERVATION
HUALPAI INDIAN RES.
Kanab
St. George
Prescott
PHOENIX
Tucson
Tombstone
Yuma
Florence
Globe
St. Johns
Holbrook
Flagstaff
Kingman
Camp Apache Mil. Res.
Camp Grant Mil. Res.
Camp Huachuca Mil. Res.
Base Line
Gila & Salt River Meridian
EXPLANATIONS
Capitals
County Seats
Cities and Towns
Rail Roads
Canals
Lighthouses
Life Saving Stations
L.H.
L.S.S
Scale of Miles
10 20 30 40 50 60
38
36
34
32
Longitude West of Washington.

power of the aristocracy through the gift of suffrage to the masses.

Aristol. $C_{20}H_{24}O_2I_2$. Diiododithymol, prepared by action of iodine on thymol; used in pharmacy.

Aristolochiaceæ. Natural family of Flowering Plants, of the class *Angiospermæ* and sub-class *Dicotyledones;* comprising 5 genera and ab. 225 species, widely distributed throughout the



Birthwort (*Aristolochia clematitis.*)

temperate and warm regions of the globe; commonly called the Birthwort family.

Aristomenes. Half legendary hero of Messenia. He successfully resisted Sparta 685–668 B.C.; withdrew to Arcadia, whence he continued to harass the Spartans, and d. in Rhodes.

Aristophanes, ab.444–ab.380 B.C. Greatest of Athenian writers of comedy; classed with the Old Comedy, although his style suggested the Middle and New schools. He employed the play to satirize and combat tendencies in politics, religion, and education which he considered to be dangerous to Athens, and caricatured the champions of obnoxious changes, especially the Sophists. Eleven of his 40 plays remain: the *Acharnians, Knights, Clouds, Wasps, Birds, Peace, Lysistrata, Thesmophoriazusæ, First Plutus, Frogs,* and *Ecclesiazusæ.*

Aristophanes, OF BYZANTIUM, ab. 264–ab.185 B.C. Grammarian at Alexandria, librarian at the Museum; teacher of Aristarchus, maker of the canon or list of classic authors, and great literary and textual critic. He introduced the use of accents in Greek, and wrote many works which have perished.

Aristotle, 384–322 B.C. Son of Nicomachus, a physician of Greek descent; b. at Stageira on the Macedonian frontier. He went to Athens at 17, and for twenty years was the pupil and associate of Plato. In 347 he went to the court of Hermeas at Atarneus in Asia Minor, whose niece he married. Later he removed to Mitylene, whence he was called by Philip of Macedon to be the tutor of Alexander the Great. In 335 he returned to Athens, where he established the Peripatetic school of philosophy and wrote the works now extant. On the death of Alexander, with whose cause he was identified, he fled from Athens, and died shortly afterward in Chalcis.

His writings were long lost: those now attributed to him were pub. about 50 B.C. They exercised a great influence on the Arabic and Scholastic philosophy, and are regarded as the most important contributions ever made to philosophy and science. They cover nearly the whole field of knowledge, and make advances in every department. The *Organum* develops formal logic much as it is now taught, and contains important discussion of scientific method and of dialectic. The *Rhetoric* and the fragment *On Poetry* contain many acute observations on human nature and conduct, which are elaborated with greater thoroughness and insight in the *Ethics.* In the *Poletics* both the ideal state and the actual political condition of Greece are discussed. In his writings on metaphysics, psychology, and science, he treats both the most abstruse problems of philosophy and an immense range of special facts. Physical and natural science may be regarded almost as his creation.

Aristotle's Lantern. System of teeth guarding the mouth of Sea-urchins. There are five teeth set in as many ossicles (the alveoli), which in turn unite at their bases each with two pairs of ossicles, and a central process.

Aristoxenus, fl. ab. 350 B.C. Greek philosopher, pupil of Aristotle. His treatise on *Rhythm* exists only as a fragment, but his valuable *Elements of Harmony,* the oldest known book on Greek music, is to be found in Meibom's *Antiquæ Musicæ Scriptores,* 1652.

Arithmetic. Science of numbers. Its beginning is found everywhere with the beginnings of civilization. Egyptian monuments show figures evidently using their hands for counting. The Roman numerals were used in Europe until the 15th century. Our present notation is of Hindoo origin, derived through the Arabs. Traces of it are found in Aryabhatta, an early Hindoo writer. With the nine digits and zero to denote position, an indefinite range is obtained. The basic notions of reckoning are addition and subtraction: then multiplication and division: still further involution and evolution. Fractions with their decimal notation, the processes of percentage, the progressions and analysis complete the subdivisions of the subject. Much has been written on the "Theory of Numbers" and their relations when combined.

Arithmetical Complement of a Logarithm. Remainder found by subtracting the logarithm from 10; used in computations by common logarithms to compact addition and subtraction of logarithms into one operation, 10 being subtracted from the sum for each complement used to obtain the required result.

Arithmetical Mean. Half sum of two magnitudes.

Arithmetical Progression. Series whose terms increase or decrease by a constant difference. Analysis of the series shows that any term equals the first term increased by the constant difference multiplied by the number of terms less one: if n = number of terms; a, the first term; d, the difference; and a_n the last of the n terms, $a_n = a + (n-1)\,d$. (1). The sum of the n terms equals the sum of the first term and last term multiplied by ½ the number of terms. $\Sigma_n = \frac{n}{2}(a + a_n)$ (2). Equations (1) and (2)—three elements being known, will solve algebraically all questions in Arithmetical Progression.

Arius, 256–336. Heresiarch; Alexandrian presbyter of much ability and learning. His views have been condemned by modern Unitarians, as making Christ to be no more man than God; but they long convulsed Christendom, and his sudden death was regarded by the orthodox as a special providence. See ARIANISM.

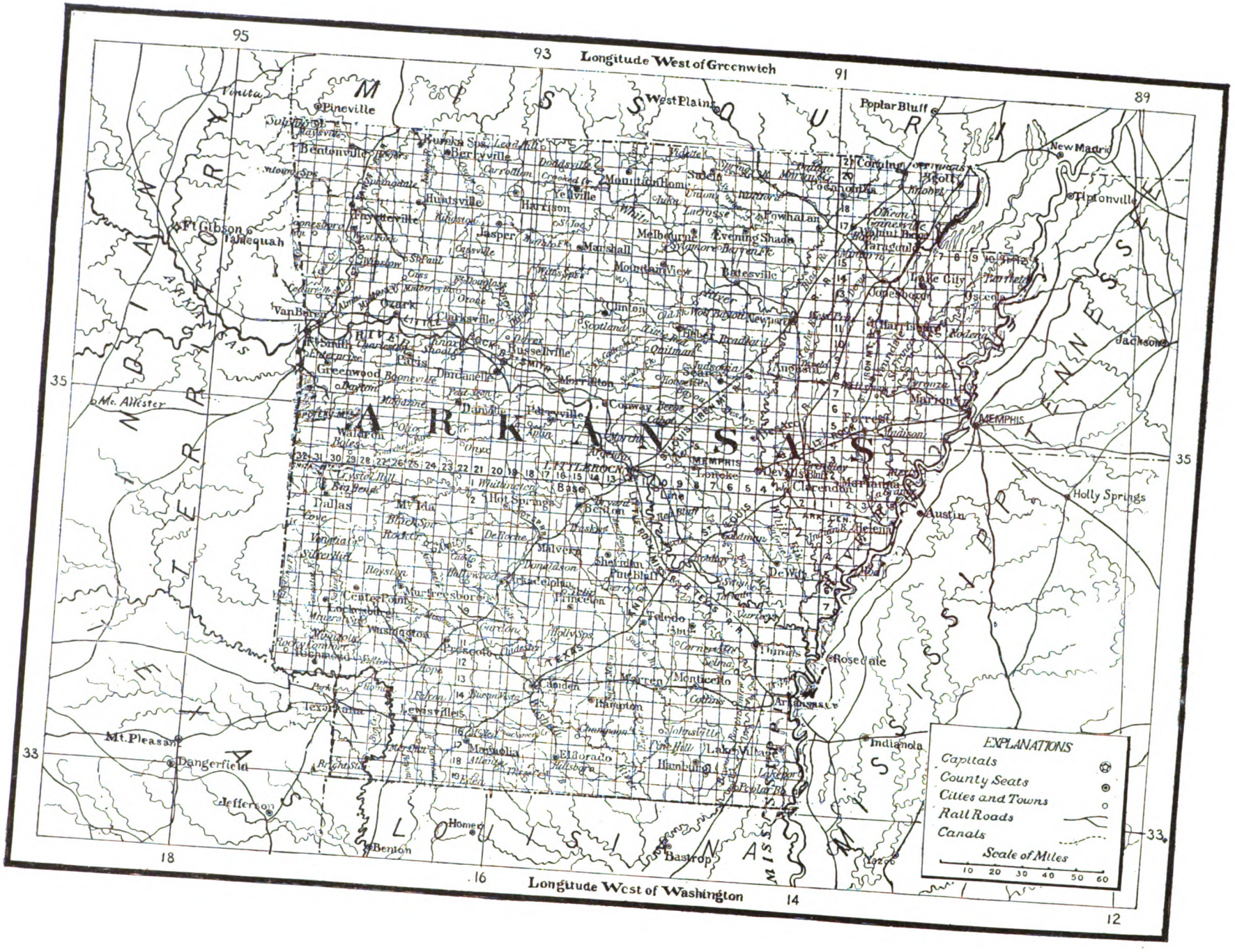
Arizona. S. w. territory of U. S. Its area is 113,020 sq. m. The n. e. part, including nearly half its area, consists of an arid plateau, having a mean elevation of from 6,000 to 7,000 ft., in which the Colorado River has cut its stupendous series of canons. The s. w. part is comparatively low, ranging from near sea level up to 2,000 ft., the limits of the high plateau being sharply outlined in most places by an abrupt descent. This lower region is composed of desert plains and valleys, intersected by narrow, sharp mountain ranges. The climate is extremely hot and arid, and agriculture is impossible anywhere without the aid of irrigation. The industries consist mainly of gold and silver mining, with a little agriculture and sheep-raising. The capital is Prescott. A. was organized as a Territory 1863, from lands ceded by Mexico 1848, or purchased 1853. Pop., 1890, 59,620, besides 16,933 Indians.

Ark. Vessel in which Noah and his family escaped the Flood; 300 cubits long, 50 wide, and 80 high. It rested on Mt. Ararat: Gen. vi.–viii.—The ark to which the infant Moses was committed was of papyrus reeds: Ex. ii. 3.

Ark. Large box or caisson, formerly used to convey coal or ore down a river; the lumber was sold on arriving at its destination. Coal was thus floated down the Lehigh and Delaware from Mauch Chunk to Phila. prior to 1830.

Ark of the Covenant. Chest of acacia-wood, overlaid with gold, 2½ cubits long, 1½ broad and deep, containing the two Tables of the Law, given to Moses at Sinai, and especially symbolizing the Divine presence. It was lost at the sack of Jerusalem and never recovered.

Arkansas. One of the s. w. States. Its area is 53,850 sq.m. The n. w. part, including nearly half its area, is broken and hilly, in some places rising to mountains of 2,500 to 2,800 ft., consisting of ridges with e. and w. trend, forming part of the Ozark hill region. The e. part is low and mainly alluvial, and large areas are subject to overflow in time of flood. The principal streams are the Mississippi, Arkansas, White and Washita. The Ozark hill region is composed of carboniferous beds, the hills and mountains being of sandstone. The s. portion is mainly composed of Eocene beds, except the alluvial tracts, which are Quaternary. The dominating industry is agriculture, and chiefly the raising of cotton. In 1890 the value of farm products was ab. $88,000,000. The cotton crop of 1891 was 830,000 bales. The State is covered with magnificent forests, and the cutting and manufacture of lumber is an industry of large and growing importance. Its railroads in 1891 had a total length of 2,287 m. The capital is Little Rock, on


Longitude West of Greenwich
95
93
91
89
Longitude West of Washington
18
16
14
12
35
33
ARKANSAS
MISSOURI
TENNESSEE
MISSISSIPPI
LOUISIANA
TEXAS
INDIAN TERR.
MISSOURI
Pineville
West Plains
Poplar Bluff
New Madrid
Tiptonville
Bentonville
Berryville
Eureka Springs
Harrison
Huntsville
Fayetteville
Fort Gibson
Tahlequah
Jasper
Marshall
Melbourne
Evening Shade
Batesville
Mountain View
Newport
Jonesboro
Trumann
Osceola
Harrisburg
Jacksonport
Marion
MEMPHIS
Van Buren
Ozark
Clarksville
Russellville
Clinton
Scotland
Greenwood
Fort Smith
Paris
Dardanelle
Morrilton
Conway
Searcy
Augusta
Mc Alister
Danville
Perryville
Forrest City
Madison
Onyx
Waldron
Boles
Little Rock
Lonoke
DeValls Bluff
Clarendon
Marianna
Holly Springs
Austin
Dallas
Mt Ida
Hot Springs
Benton
Brinkley
Helena
Black Spr
Dellroche
Washbd
Malvern
Sheridan
Pine Bluff
DeWitt
Center Point
Murfreesboro
Princeton
Gillham
Holly Sps
Texarkana
Camden
Warren
Monticello
Tillmans
Rosedale
Hampton
Arkansas R.
Mt. Pleasant
Dangerfield
Lewisville
Magnolia
Eldorado
Hillsboro
Hamburg
Lake Village
Indianola
Jefferson
Homer
Benton
Bastrop
Mississippi R.
EXPLANATIONS
Capitals
County Seats
Cities and Towns
Rail Roads
Canals
Scale of Miles
10 20 30 40 50 60

the s. bank of the Arkansas. Other important cities are Ft. Smith, upon the w. boundary, and Hot Springs, a watering place. The region was colonized by the French 1720, and purchased by the U. S. 1803 as part of La. A. was set off 1819, from a part of Missouri Territory, and admitted as a State 1836. Pop., 1890, 1,128,179, 311,227 being colored, and few of foreign birth. Density of pop., 21 to sq. m.

Arkansas Post, ARK. Taken by Union forces Jan. 11, 1863.

Arkansas River. Large right branch of the Mississippi. It heads in the Rocky mountains of Col. and flows generally s. e. across Kan., Ind. T., and Ark. Length 2,170 m., drainage area 185,671; navigable at high water to Ft. Smith, Ark; average flow 63,000 cub. ft. per second.

Arkansite. TiO_2. Black variety of titanium oxide (Brookite), found in Ark.

Arkwright, SIR RICHARD. 1732–1792. Inventor of the spinning-frame for cotton warp, patented 1769. He was knighted 1786.

Arles. City of s. e. France, on the Rhone, noted for its amphitheater and other Roman remains; capital of a Burgundian kingdom 932–1032. Pop., ab. 24,000.

Arm. Upper limb, or, more properly, that portion of it above the elbow.

Fig. 1.—Bones of the Human Arm: *h*, humerus; *r*, radius; *u*, ulna; *w*, wrist-joint; *hd*, hand; *s*, scapula; *c*, clavicle, or collar bone.

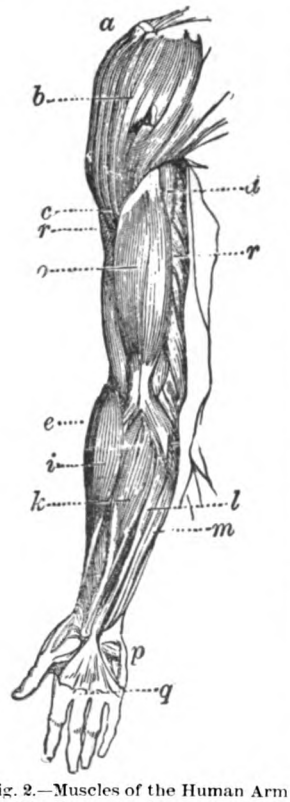


Fig. 2.—Muscles of the Human Arm: *abc*, deltoid muscle; *d*, coraco-brachialis muscle; *r*, *r*, triceps; *e*, *i*, extensors of wrist and long supinator of the hand; *km*, flexor of fingers and radial and ulnar sides of the wrist, and *l*, palm of the hand, or palmaris longus; *p*, palmaris brevis; *q*, palmar fascia; *o*, biceps.

Armada, THE INVINCIBLE. Collected for the subjugation of England by Philip II. of Spain, 1587. It consisted of 132 ships with 3,165 cannon, 8,766 sailors, 2,088 galley slaves, 21,855 soldiers, 1,355 volunteers commanded by the duke of Medina-Sidonia; sailed from Lisbon May 19, 1588; entered the Channel July 19; suffered in several engagements July 21–29; retreated n. around the Orkneys and met great loss from severe storms.

Armadillo. See LORICATA (*Edentata*) and DASYPODIDÆ.

Armagh. City of Ireland, capital of Co. A., seat of an archiepiscopal see, traditionally traced to St. Patrick. Its abp. is styled Primate of all Ireland; the abp. of Dublin, Primate of Ireland. Pop. ab. 10,000.

Armancier Mountain-Gun. See GUNS, MOUNTAIN.

Armata. Group of Gephyrean worms including the *Chætiferi* and *Tubicoli*.

Armature. I. Piece of soft iron which, when placed in contact with the two poles of a magnet, completes the magnetic circuit between them; sometimes called a "keeper," as it prevents the loss of magnetism.

II. One or more coils of insulated copper wire surrounding a core of soft iron; usually made the movable part of a dynamo, or magneto-electric machine; when made to rotate between the poles of the field magnets, currents are induced in the coils. Armatures may in general be divided into two classes: the ring or Gramme Armature, in which the coils are grouped upon a ring, whose principal axis of symmetry is also its axis of rotation; and the drum or Siemens Armature, in which the coils are wound longitudinally over the surface of a drum or cylinder. Ring armatures are used in the dynamos of Pacinotti, Gramme, and Brush, while the drum armatures are found in the machines of Siemens, Edison, Weston, and Thomson-Houston. A few special types of machines use pole armatures, having their coils wound on separate poles projecting radically around the periphery of a disc or central hub. Other special machines contain disc armatures in which the coils are flattened against a disc.

III. Sectors of paper placed upon the fixed plate of an influence electrical machine, as those of Holtz, Soepler and Voss.

IV. Conducting plates of tin-foil placed on either side of the dielectric in an electric condenser.

Armature Coefficient. Constant depending upon the number of turns of wire b in the armature of a dynamo-electric machine, upon the average area a of the turns, and upon a coefficient k, which represents the number of times the effect is increased by the soft iron core. If we represent the armature coefficient by A, we may write, $A=kab$. k is the "coefficient of magnetic permeability" of the core. The quantity A is sometimes called the "equivalent area," and is the area of a single turn of wire which would produce the same difference of potential as the armature in question, including its many turns and core.

Armed Neutrality. That condition of a nation by which it maintains an armed force to repel any aggression on the part of belligerent nations between which it desires to remain neutral.

Armed Strength of Europe. SEE TABLE.

Armenia. Ancient country of s. w. Asia, whose inhabitants were of Caucasian stock; conquered by Assyrians and Persians, and by Alexander 325 B.C.; regained independence ab. 190, and was ruled by the Arsacidæ. The Armenians became Christians ab. 300. A. has since been theater of many contests, and is now divided between Russia, Persia and Turkey. Alleged revolts in the winter of 1894–95 formed the excuse for Turkish massacres, which caused great indignation in Europe and America.

Armenian. Indo-European (or Aryan) language, with written records dating from 4th century. It was formerly ranged under the Iranian group, but is now recognized as independent.

Armenian Bible. Tr. 410–435 by Miesrob and the patriarch Isaac. The Syriac Peshito version was first taken as a basis, but the Greek was afterward used.

Armenian Church. Established 289, through Gregory the Illuminator, who became hierarch 302; independent and isolated since 491; usually called MONOPHYSITE (q.v.), though this is denied. Most of its doctrines and rites resemble those of the Greek Church. It has four patriarchates, and ab. 4,000,000 members, most of them in the Turkish dominions; its head or Catholikos lives in Russia. Some, living abroad, submitted to the Pope in 1316–34, and formed the United Armenians; this body has lately been divided. The A. B. C. F. M. founded a mission in 1831, and in 1850 an Evangelical Protestant Church. Many of the clergy in Turkish Armenia are said to have fallen in the massacres of 1894–95.

Armenian Literature. Although the heathen authors have perished, traces exist to show that they were quite numerous. Christianity stimulated Armenians to study and translate from the Greek and Latin, and some books which would otherwise have perished are preserved in these versions, as the *Chronicle of Eusebius*. In the 5th century Miesrob developed and changed the Armenian alphabet. His pupils wrote various histories and other works. Thus Yeghishe or Elisaeus treated of the wars with Persia, and Moses of Khorene was the greatest historical writer of his race. In the 6th century the successes of the Persians destroyed literary activity for a time, though isolated writers remain from 700 to 1100. The next two centuries witnessed a revival of interest in letters. Since the 17th century the printing press has brought about a renewed activity in literary study and production.

Armenians. People of Iranian stock, inhabiting Asia Minor s. e. of the Black Sea, where are ab. 200,000; but in Russia are still more, and in Persia about half as many. They are intelligent, handsome, and woman holds a high position. The complexion is copper-colored.

Armilla. Plaited membranous frill surrounding the summit of the stipe in certain toadstools.

ARMED STRENGTH OF PRINCIPAL EUROPEAN NATIONS.

Nation.	*Area in Square Miles.*	*Population.*	*Latest Yearly Expenditures for Military Budget.*	*Available and Total Strength.*				*Conditions for Military Service.*
				No. of Young Men who have reached Registry Age and No. Incorporated in Active Army Yearly.	*Peace-Footing.*	*War-Footing.*	*Ultimate Prospective Strength.*	
Austria-Hungary.	263,700	42,845,000	$55,235,000	345,150 Registered, 103,000 Incorporated.	318,000	1,794,175	2,581,315	Universal and lasts for 22 years. Recruits when drawn are posted into: (*a*) Active Army. (*b*) Reserve. (*c*) Landwehr.
Belgium.	11,200	6,132,000	9,346,000	61,000 Registered. 13,300 Incorporated.	48,859	140,000	140,000	Registered at age of 20 years, and subject to conscription. Army is recruited partly by voluntary enlistment and partly by conscription. Term of service is 13 years.
United Kingdom (Great Britain).	120,973	38,609,500	89,000,000	Voluntary Enlistments. 35,000 Regular. 45,000 Militia.	Regular Army 142,000 in England and in Colonies. 77,000 in India.	80,000 Reserves of Reg. Army. 125,000 Militia. 10,000 Yeomanry. 228,000 Volunteers. 219,000 Regular Army. 662,000		Enlistment voluntary. Term 12 years, of which 7 are with the colors and 5 in the reserve.
France.	206,953	38,343,192	127,000,000	277,425 (Reg. in 1892) 181,872 Incorporated.	538,709	1,400,000 Active and Reserve. 600,000 Territorial Army. 850,000 Res. of Ter. Ar'y not org'd 2,850,000	3,430,000	Liability to service from 20 to 45 years of age, of which: 3 years with Colors. 10 " " Active Army Reserve. 6 " in Territorial Army. 6 " " " Reserve.
Germany.	208,739	49,426,384	118,118,425	437,000 Registered. 228,000 Incorporated.	598,000	2,000,000 A't've A. Res. 1st ban L'd'r 1,000,000 2d ban Landwehr. 700,000 Landsturm. 3,700,000	4,142,000	Liability universal from 20 to 45 years of age, of which: 2 years in Active Army. 5 " " " Reserve. 5 " " 1st ban Landwehr. 7 " " 2d " " 6 " " " " Landsturm.
Italy.	109,813	30,347,291	48,000,000	267,850 Registered. 105,000 Incorporated.	218,000	818,255 Permanent Army. 521,452 Active Militia. 654,419 Territor'l Militia (trained) 1,994,126 1,160,910 Ter't. Militia (untrained) 3,155,036 for War.		Universal and from 20 to 39 years of age.
Russia.	8,663,877	112,935,000	186,349,000	860,000 Registered. 260,000 Active Army 300,000 General Levy Incorporated.	880,000	2,400,000 Regulars. 200,000 Cossacks. 600,000 Reserves. 3,200,000 7,000,000 Untrained. 10,200,000	5,014,865 tr. 8,000,000 u'tr 13,014,865	Universal, 23 years' duration, of which: 5 years in Active Army. 13 " " Reserve. 5 " " Opoltchenie.
Spain.	191,896	17,600,000	28,128,000	141,000 Registered. 39,500 Incorporated.	111,000	200,000 Permanent. 200,000 Reserve. 400,000	404,437	Universal and lasts for 12 years.

Armillary Sphere. Ancient astronomical instrument used for determining the positions of the heavenly bodies. It consisted of a number of circles so placed as to represent the relative positions of the principal circles of the celestial sphere. It is supposed to have been invented by Eratosthenes 200 B.C. or earlier.

Armillary Sphere

Arminians. Those members of the Reformed churches who maintain the foresight of faith to be the ground of salvation, and modify or disown the severities of the Genevan doctrine concerning Predestination. See ARMINIUS.

Arminius, or HERMANN. 18 B.C.–A.D. 19. Chief of the Cherusci. He became a Roman knight; persuaded the Germans to rise, and annihilated the Roman army under Varus A. D. 9; fought Germanicus 14–16; was suspected of aiming at absolute power, and slain by his relatives.

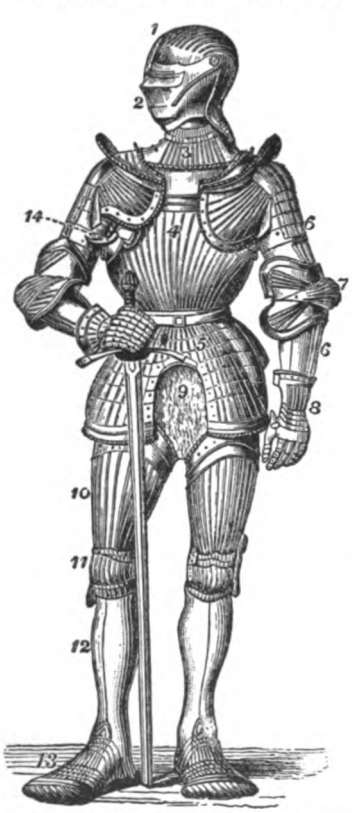
Arminius (JACOBI HARMENSEN), 1560–1609. Dutch theologian; prof. Univ. Leyden 1603, and its rector 1605; begetter of a controversy which raged for 200 years with wholesome effect. His views as to Free Will and Divine Decrees have been adopted by all Methodists and many Anglicans, and in a modified form by New School Calvinists. His followers were called Remonstrants at the time, and Arminians later.

Armistice. Truce between contending powers, usually preceding peace, as in the Crimean War 1856, the Franco-German 1871, and China-Japan war 1895.

Armitage, THOMAS, D.D., b. 1819. Baptist pastor in N. Y. 1848–88; founder of the American Bible Union, and its pres. 1856–75. *History of the Baptists*, 1886.

Armor, ANCIENT. Defensive body-covering, in general use from the earliest historic times till ab. 1520. Shields, helmets, and corslets of plate-armor are figured in the reliefs or paintings of Egypt and Assyria. With the Greeks bronze was the material first employed. The use of greaves, or leg armor, began with them, as far as known. So, apparently, did the cuirass, consisting of two solid pieces for the front and back, which also continued in Roman use. Body-armor of chain mail characterized the earlier Middle Ages. This was gradually displaced by jointed plate-armor from the 14th century. This reached its most cumbrous and also most extensive use in the 16th century, when the wider use of firearms began to make it practically useless. The survival of the cuirass in the 17th and 18th centuries was rather traditional than practical, but it is still worn by certain cavalry regiments of Europe. See BULLET-PROOF CLOTH.

From Brass of Sir John de St. Quintin, 1397:



Complete Suit of Plate-armor, beginning of 16th Century:

1, helmet; 2, visor; 3, gorget; 3*a*, camail; 4, breastplate; 5, skirt; 6, armpieces; 7, elbow-piece; 8, gauntlet; 9, hauberk; 10, thigh-piece; 11, knee-piece; 12, greaves; 13, sollerets; 14, lance-rest; 15, belt.

Armored Defenses. Owing to the enormous velocity and great mass of modern projectiles, masonry forts can no longer withstand their striking energy. Since 1855 sea-coast fortifications have been gradually protected by armor plates on their assailable fronts. These plates are of chilled cast iron, as in the Gruson shield, or of iron or steel, or a combination of the two. These devices have not yet reached a stage of final development.

Armorica. Old name of n. w. Gaul, reaching from the Seine to the Loire; now Bretagne or Brittany. The language resembles Welsh.

Armor-Piercing Projectiles. See PROJECTILES.

Armor Plates for Warships. The inventive Hollanders, in raising the siege of Leyden in 1574, employed a paddle-wheel floating structure called "The Ark of Delft," which was covered with shot-proof bulwarks, and was probably the forerunner of the armor-clad. In 1812 John Stevens of New Jersey proposed the employment of inclined armor in his designs, and by 1841 had determined the resisting power of iron against cast-iron shot. Experiments in England in 1827 and 1840 with wrought-iron bars and iron plates respectively gave unfavorable results. In 1841 the French general Paixham recommended the use of iron to protect ships from the shells he had invented.

In 1845 Dupuy de Lome submitted his first project for an armored frigate. In 1854 John Ericsson submitted a design of a monitor to Napoleon III. Coles proposed a similar design 1855. October 17, 1855, the first sea-going iron-clad fleet (French) was successfully tested at Kinburn; these vessels were armored with 4½ inches of iron. England quickly followed with slightly heavier batteries. From 1856 to 1861 much experimentation took place, and in the U. S., 1861–65, many expedients were tried which gave a marked impetus to armor-clad construction. The monitors of this period developed into the battle-ships of to-day. By 1854 the manufacture of iron armor became a distinct industry, and 1859 saw the acceptance of turret armor.

In 1867 experiments were made with the plate-upon-plate system, in which several plates in direct contact were employed. These were of value until the manufacturers were able to make good thick plates which had proportionally greater resistance.

In 1872 British experiments proved that turrets and their gear would not necessarily be disabled by contortion or racking.

This same year Admiral Ammen, U.S.N., proposed a plan of deck armor for a ram that promised the best deck protection, but such a ram was not laid down until 1891. She was completed in 1894, but has not yet been tested.

The noted Spezia trials of 1876 demonstrated the superiority of Schneider steel over wrought-iron of both British and French manufacture. These results led to the production of the type known as British compound, adopted in 1877. To this England tenaciously held until the Annapolis trials of 1890 so completely demonstrated the superiority of Schneider steel and nickel-steel that another extensive series of experiments was ordered, which resulted in Great Britain accepting the all-steel carbonized type under a combination of the Ellis (British) and Harvey (U. S.) patents.

In 1889 Schneider made some excellent nickel-steel armor, in 1890 it became an accepted type, and has since been largely employed in the U. S., France, and Germany. Practically all plates are now made of homogeneous steel, compound armor having been replaced by it. The heaviest plates are 22 inches thick. The Bethlehem Iron Co., and the Carnegie Co., Pittsburg, are the only American makers of armor plate; 36 inches of oak are usually employed behind heavy armor.

With chilled-iron armor, the surface is hardened by being cast and chilled in a metallic mold. Gruson (German) chilled iron has been employed for land turrets, and has high resisting power.

Wrought-iron armor was manufactured from puddled ball and bar, by slabbing, piling and rolling.

Steel armor is nearly all made of open-hearth steel. Deck-plates, shields and splinter bulkheads are rolled. Ammunition

hoists and tubes, and conning towers, are hollow forgings. All other heavy armor is shaped under the hydraulic forging press, steam-hammer, or rolling-mill.

Nickel steel is made by the addition of 3½ per cent of nickel, and has proved of great value. A lower carbon and treatment at lower temperatures are secured thereby. Schneider of Le Creusot, France, was the first to successfully use it.

Carbonized armor is manufactured in the same manner as steel armor, supercarbonized at a high temperature and suddenly chilled. The carbon of the surface is increased to 1 per cent by gas, bone, or other charcoal processes; the hard face is secured in different ways by various manufacturers, generally by the application of salt ice-water.

Nickel-chrome steel contains 2 per cent of nickel and 1 per cent of chromium. St. Chamond of France is the most successful maker of this type.

Compound armor was manufactured for many years under Ellis and Wilson patents (British) in Great Britain, Germany, France and Russia. It consists of ⅞ iron with ⅛ steel face.

Ellis (Brown) system consisted of a wrought-iron foundation (back) plate and wrought-steel (face) plate united by liquid steel; subsequently rolled to the required thickness. Tresidder substituted 2 per cent nickel steel for the face plate.

Wilson (Cammell) system consisted of thin iron plates rolled together to form foundation (back) plate, which after thorough scaling receives liquid steel to form the face plate; the whole is then rolled to the required thickness.

Sandwich armor was composed of alternate layers of metal and wood; not now employed for ships. The British ship *Inflexible* has this 26 in. thick.

The severest requirements are those of the U.S., and comprise, in addition to a personal official inspection of all operations, chemical analysis, physical tests for elongation, tensile-strength and uniformity, and a ballistic test of one or more plates selected from a lot the weight of which is determined by the naval inspector. The ballistic test consists of firing a certain number of projectiles against the selected plate at determined energies for cracking and perforation.

Armory. See ARSENALS.

Arms, ANCIENT. In prehistoric ages the same offensive weapons were used which are now found with those still existing primitive peoples to whom wood and stone are the most accessible materials, viz., the club, mace, spear, bow and arrow, and sling. It was the introduction of copper, bronze, and iron which gave a more extensive use to the sword and spear. These metals were probably used in Chaldea and Egypt in the time of oldest monuments or records, ab. 4000 B.C. Their introduction into Europe was one of the phases of the transition from the Stone Age to the Bronze Age, probably ab. 1500 B.C. Although the bow was nowhere abandoned in consequence of this change, the ancient Orientals, as distinct from the classic nations, continue to employ it generally. In the Middle Ages both kinds of weapons were used indifferently, although the bow was confined to foot-men, until the development of the cross-bow, and then of firearms, gradually tended to displace the weapons of hand-to-hand fighting. In this development the use of artillery (13th century) preceded that of hand fire-arms, which first appear in the shape of diminutive and portable reproductions of the larger cannon. Culverins and petronels appear ab. 1310. The long-barreled arquebuse, the ancestor of the musket, was invented in Spain ab. 1475. It was fired by a priming-pan and match. The flint-lock was invented in France ab. 1640, but did not supersede the match-lock generally until ab. 1700. The percussion-cap musket was invented in Scotland in 1807. Ancestors of the modern breech-loaders, revolvers, and repeating weapons go back to the 15th century, as does also the practice of rifling. The bayonet was invented at Bayonne ab. 1650.

Armsby, HENRY P. American agricultural chemist, director of the Pennsylvania Agricultural Experiment Station. *Manual of Cattle Feeding*, 1880.

Armstrong, JOHN, M.D., 1709–1779. Scottish poet. *Art of Preserving Health*, 1744.

Armstrong, WILLIAM GEORGE, LORD, LL.D., D.C.L., F.R.S., b. 1810. Inventor of the hydro-electric machine 1840, the hydraulic crane 1845, and the Armstrong gun 1854; founder of the Elswick engine-works at Newcastle 1847; knighted 1858, made a baron 1887.

Army. Organization for combat, command and supply. The theory of organization rests on two important principles, individual responsibility and subordination; so that wherever a fraction of an army may be, one soldier is individually responsible for the command, and the remainder are subject to his orders. It exists by virtue of the fundamental laws of the Government it serves; its supreme command must of necessity be vested in the head of the nation. Under him, a series of subordinate commanders subdivides the command and carries the responsibility down to its minutest fraction. Such a system is called a Military Hierarchy. In civilized nations, the military forces are divided first into armies, army corps, divisions, brigades, regiments, battalions, and companies. For drill the companies may be subdivided into platoons, sections, and squads. In all these parts the relative rank and limitations of each officer as to command, and the methods of transmitting and receiving orders and establishing responsibility, are rigidly fixed by regulations. See ORGANIZATION OF EUROPEAN ARMIES.

Army Corps. Two or more divisions. A corps is complete in itself as an army, having infantry for its main body, and such proportions of the other arms of the service as to make it capable of successfully defending itself or attacking the enemy. It is commanded by a major-general.

Army History. Comprises the greater bulk of ancient and a considerable proportion of modern history, and is a record of the development of the Military Art According to Prince Galitzen it may be considered under four heads and appropriate sub-divisions:

A. Ancient War:
1. To the beginning of the Persian wars, 500 B.C.
2. To the death of Alexander, 323 B.C.
3. To the death of Cæsar, 44 B.C.
4. To the fall of the West Roman Empire, 476 A.D.

B. Wars of the Middle Ages:
1. To the death of Charles the Great, 814 A.D.
2. To the introduction of fire arms, 1350.
3. To the beginning of the Thirty Years' War, 1618.

C. Modern Wars:
1. The Thirty Years' War, 1618–1648.
2. To the epoch of Frederick the Great, 1740.
3. To the French Revolution, 1792.

D. Recent Wars:
1. The period from 1792–1805.
2. Napoleon's Wars, 1805–1815.
3. Wars since 1815.

In the early oriental wars strategy was unknown and the tactical formation for battle was almost invariably the parallel order. Devastation and cruel slaughter transformed these wars into huge destructive raids from which no valuable military lessons can be derived. Organization and discipline were the elements which enabled the small armies of the Greeks and Romans to overthrow vastly superior numbers in armies lacking these qualities. The phalanx, resistless in shock and immovable by its solidity, was peculiar to the Greeks; the legion of the Romans, possessing greater mobility, was better adapted for maneuver on more varied ground. The campaigns of Alexander, Hannibal and Cæsar demonstrate the value of discipline and training, and the progressive military spirit called out by their genius for war. The introduction of the mercenary system, the prostitution of civic virtue, and the despotism of the emperors, are the efficient causes of the subsequent decadence.

The feudal period was one of retrogression: countries and provinces invaded and ravished, cities ruined, castles razed, wholesale butcheries of inoffending peasants, are not the characteristics of progressive civilization. The victory of the Swiss Confederates at Morgasten in 1315 over the flower of Austrian chivalry established the importance of infantry and marked a new epoch.

The invention of fire-arms, the substitution of the bayonet for the pike, the introduction of the cartridge, the establishment of field artillery and increased mobility were notable events, although the defects of the parallel order, the mixing of cavalry with infantry on the battle front, the deliberate maneuvers, and lack of appreciation of the resources of the battleground, still existed.

The important changes of the modern war period belong mainly to the improvement in fire-arms and changes in the order of battle, as exemplified in the campaigns of the great Frederick. The system of skirmishers and columns of attack arose in the wars of the French Revolution, and to Napoleon, the great master of the art of war, are due an appreciation of the proper relation of each arm, and of their respective powers; also an insight into the science of strategy and of tactical combinations.

Although it has taken nearly twenty-five centuries to pass from the massive Grecian phalanx to the single open rank formation of infantry, and from the heavy Macedonian pike to the magazine breech-loader, it seems marvelous that the conditions which exacted every able-bodied citizen to be a soldier

in the ancient armies is paralleled by the civilized countries of continental Europe to-day.

The numerical strength of armies is necessarily limited by the enormous difficulties attending their subsistence, transportation, organization and discipline, and by the rare quality of leadership. Ancient armies, recruited from non-homogeneous peoples, lacked cohesion; and although their records are somewhat untrustworthy, their probably great numerical strength is marvelous. Only modern armies of the present century, highly organized and disciplined, approximate to them in this respect.

Rameses II. (1388–52 B.C.), whom the Greeks, by a peculiar tradition arising from the bombastic expressions common to the royal inscriptions of the Egyptians, transformed into the military hero Sesostris, was accredited with an army of 650,000 men. The army of Xerxes for the invasion of Greece (480 B.C.), recruited from forty-six Asiatic nations, has been variously estimated from 2,000,000 down. On leaving Sardes it had a probable strength of 900,000 and required seven days steadily moving to cross the Hellespont.

The unsuccessful expedition of Darius against the Scythians (513 B.C.), with an army estimated 700,000 men, failed from lack of homogeneity and organization. As a contrast to these enormous hordes, Alexander's army of 30,000 infantry and 5,000 cavalry, highly organized and disciplined, crossed the Hellespont (334 B.C.) and entered upon its wonderful career of conquest. By recruits from Greece and conquered nations it subsequently grew to much greater proportions. Hannibal leaving Spain (218 B.C.) with 50,000 foot and 9,000 horse, traversed Gaul, crossed the Alps by the little St. Bernard Pass, penetrated Italy and fought the remarkable battles of Lake Trasimene and Cannæ.

The foundation of the present military power of Prussia was laid by Frederick William (1713–40 A.D.), who maintained a standing army of 83,000 men in a country of only two and a half millions of inhabitants. His son, Frederick the Great, with an army 80,000 strong invaded Bohemia (1744) and Saxony (1756) with an army of 67,000 men. In the Napoleonic wars examples are numerous of great armies. Thus in 1805 Napoleon by wonderful strategic marches moved his army of 200,000 men from the Camp at Boulogne on the English Channel across France to the Danube, and forced the surrender of the Austrians at Ulm. In 1809 the campaign against Vienna, ended by the victory at Wagram, employed a France-Allied army of 317,000 against an Austrian of 313,000. In the invasion of Russia (1812) Napoleon's army, consisting of 11 corps of infantry, 4 of cavalry, the Guards and Austrian contingent, numbered 509,700 men. Of this number 480,000 crossed Prussia, but not more than 340,000 advanced on the Dwina.

During the War of the Rebellion in the U. S. 2,772,670 men were furnished by the loyal States and Territories for the Union armies. The effective strength of the army at various dates was:

Jan.	1, 1861 . . .	14,663	(wholly Regulars).	
July	1, 1861 . . .	183,588	Regulars	and Volunteers.
Jan.	1, 1862 . . .	527,204	"	" "
March	31, 1862 . . .	533,984	"	" "
Jan.	1, 1863 . . .	698,802	"	" "
Jan.	1, 1864 . . .	611,250	"	" "
Jan.	1, 1865 . . .	620,924	"	" "
March	31, 1865 . . .	657,747	"	" "
May	1, 1865 . . .	797,807	"	" "

This great force was spread over an immense territory, organized into twenty-five army corps, and a cavalry corps whose strength varied from time to time owing to exigencies of the service. The main and secondary armies were formed of one or more army corps, according to the importance of their mission, and were known as Army of the Potomac, Virginia, Ohio, Cumberland, Tennessee, Mississippi, Gulf, James, West Virginia and Middle Military Division.

In the Austro-Prussian War (1866) Prussia mobilized an army of 326,000, and the Austrians a northern army under Benedek of 240,000, and a southern army of 100,000. The superiority of Prussia caused the war proper to end in a month. In the Franco-German War (1870) the French organized a grand army of 250,000, with a reserve of 320,000, while the Germans mobilized a total force of 850,000. In this war the surrender of great armies by the French at Sedan and Metz and the marvelous succession of predicted military operations are the most marked features. See ARMED STRENGTH OF EUROPE.

Army Regulations. Issued by the War Department, by direction of the Pres., for the government of the personnel of the army. They comprise provisions relating to officers, enlisted men, public property, money and accounts, and the several staff departments.

Army Worm. Larva of *Leucania unipuncta*, very destructive, almost omnivorous; common in U. S. The parent moth is reddish brown with white dot on front wings. It travels in great numbers; hence the name.

Army Worm.

Arnaud, HENRI, 1641–1721. Waldensian pastor and commander. When his people were expelled from s. France, he led them back, defeating the royal armies in 1689. He was a colonel in the allied army 1702–13, and in his last years preached to the Waldenses in Würtemberg.

Arnauld, ANTOINE, 1560–1619. French orator; advocate-general 1585. His speech against the Jesuits 1594, led to their banishment.—His youngest son, ANTOINE, called "the great Arnauld," 1612–1694, became the leader of the Jansenists, was expelled from the Sorbonne 1656, and in 1679 fled from persecution to Flanders. He was a prolific writer. *Port Royal Logic* (with P. Nicole), 1662.—Another son, HENRI, 1597–1692, was Bishop of Angers from 1649.—Their eldest brother, ROBERT D'ANDILLY, 1589–1674, wrote *Lives of the Fathers of the Desert*, 1668, tr. 1757.

Arnauld, JACQUELINE MARIE (*La Mère Angélique*) 1591–1661. Daughter of Antoine; abbess of Port Royal, center of the Jansenist movement in France. Receiving this important post in childhood, she resigned it 1626, but became prioress 1636.—Her niece, ANGELIQUE DE ST. JEAN, 1624–1684, daughter of Robert, was prioress of Port Royal 1669, abbess from 1678, and wrote memoirs of her aunt and of the convent.

Arnault, VINCENT ANTOINE, 1766–1834. French dramatic poet; Academician 1829. *Marius*, 1791; *Germanicus*, 1816; *Souvenirs*, 1833.

Arndt, ERNST MORITZ, 1769–1860. German poet; prof. at Greifswald 1806, Bonn 1818–19, and again from 1840; author of the national song, "What is the German's Fatherland?" *History of Serfdom in Pomerania and Rügen*, 1807; *Souvenirs*, 1840.

Arndt, JOHANN, 1555–1621. German Lutheran divine. *True Christianity*, 1605–9, tr. 1712–14; *Garden of Paradise*, 1612, tr. 1716.

Arne, THOMAS AUGUSTINE, Mus. Doc., 1710–1778. English composer of numerous operas, masques, and oratorios. He reset Addison's *Rosamond*, 1733. Author of the music to *Comus*, 1738, and to *Rule Britannia*, in his masque *Alfred*, 1740.

Arnheim. City of the Netherlands, on the Old Rhine. Pop., 1891, 50,194.

Arnica. Yellow-flowered plant of the *Compositæ*, *Arnica montana*, native of Europe and Asia. The officinal tincture is obtained from the flowers, and is used externally for wounds.

Arnica montana.

The various preparations of the root and flowers of this plant are largely used in domestic medicine, but are of little value, and must not be used indiscriminately, as severe headache, disturbed action of the heart, and other nervous phenomena have resulted from overdoses.

Arnim, Ludgwig Joachim von, 1781–1831. German poet and novelist. *Crown Guardians*, 1817.—His wife, Bettina (Brentano), 1785–1859, corresponded as a child with Goethe, and tr. his letters, 1835. *Die Günderode*, 1840.

Arno. River of Italy, rising in the Apennines, and partly navigable to Florence.

Arnobius. Christian apologist, converted ab. 303. His *Disputations against the Heathen* were written soon after, and, it is said, as a condition of admission to church fellowship.

Arnold, Benedict, 1741–1801. American general. When in command at West Point, he offered to surrender to the enemy. The scheme failed by the arrest of André, while the traitor A. escaped and joined the British army.

Arnold, Sir Edwin, b. 1832. English poet and journalist; knighted 1888. *Light of Asia*, 1879. Of late years he has written much about Japan.

Arnold, George, 1834–1865. American poet and humorist.

Arnold, Gottfried, 1666–1714. German pietist and hymn-writer. His *Impartial Church History*, 1699, apologizes for heretics.

Arnold, Lauren Briggs, 1814–1888. American agricultural and dairy investigator; lecturer Cornell Univ. 1878–87. *American Dairying*, 1875.

Arnold, Matthew, LL.D., 1822–1888. English poet, critic and essayist; eldest son of Dr. Thomas; long Inspector of Schools; Prof. of Poetry at Oxford 1857–67. An elegant writer and a fearless thinker, he was the apostle of "sweetness and light." His *Culture and Anarchy*, 1869, *St. Paul and Protestantism*, 1870, *Literature and Dogma*, 1873, and other prose works have deeply influenced the religious thought of our time.

Arnold, Thomas, D.D., 1795–1842. English educator and author. *History of Rome*, 3 vols., 1838–42. As head-master of Rugby School from 1827, he trained some of the brightest minds in England, and earned the fame of a model teacher.

Arnold, of Brescia, ab. 1100–1155. Italian reformer; pupil of Abelard, and condemned with him 1140. At Rome, 1146, he sought to restore the Republic. After much commotion, the city was put under an interdict; A.'s partisans deserted him; he was arrested by the Emperor Barbarossa, and executed.

Arnot, William, 1808–1875. Scottish divine. *Proverbs*, 1857–58; *Parables*, 1865.

Arnould, Sophie, 1744–1803. French singer and actress.

Aromatic Compounds. Containing a nucleus of 6 carbon atoms united with each other in a closed ring or chain, and changed into nitro compounds by nitric acid, sulphonic acids by sulphuric acid, and bromine compounds by the direct action of bromine; derived from benzene, C_6H_6, by replacing the hydrogen by other elements or groups.

Aromatic Vinegar. Concentrated acetic acid, perfumed by some essential oil, as lavender, rosemary, or cloves. It is volatile and corrosive, and is used as a stimulant by smelling in headache and fainting.

Arpads. Dynasty of Arpad, Magyar leader, who d. 907; male line extinct 1301.

Arquebuse. Early form of musket with rudimentary trigger; successor of the gun which was fired by application of a slow-match to touch-hole. In the 16th century some "great harquebuses" are said to have thrown balls of four to the pound.

Arquebusier.

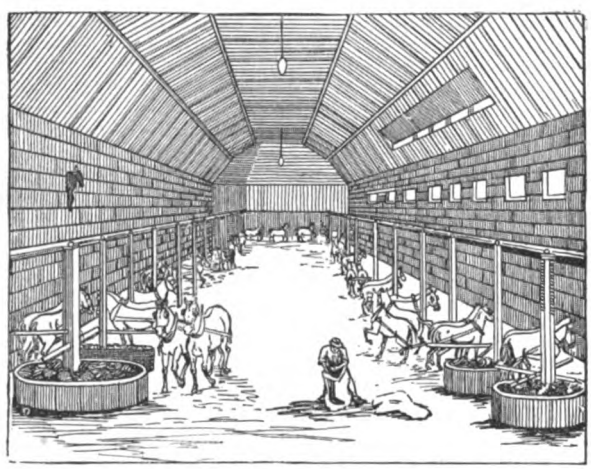
Arques. In n. France; scene of a victory of Henry IV. over Mayenne and the League, Sept. 21, 1589.

Arrack. Spirituous liquor made in East Indies from rice, which is germinated, fermented and distilled. Some has molasses, or the distillate from the juice of the cocoanut, added to the mash.

Arran. Island of Scotland, one in the Frith of Clyde, area 165 sq. m.; three off Galway Bay, Ireland, 18 sq. m.

Arras. Ancient city of n. France, famous in Middle Ages for its tapestry. It formerly belonged to the Low Countries, and was taken by storm or siege 1482 and 1640. Robespierre was b. here.

Arrastre. Crude apparatus for grinding and amalgamating gold and silver ores by dragging blocks of stone upon a wooden floor; used in Mexico and s. w. U. S.



Arrastre.

Arrebo, Anders Christensen, 1587–1637. "Father of Danish poetry." His most noted poem is the *Hexaëmeron*.

Arrenotokia. Form of parthenogenesis, in which males are produced from unfertilized eggs, as in bees.

Arrest. Taking a thing or a person into legal custody. It is applied to the seizure of property in admiralty. The arrest of a person may take place in civil suits, chiefly those for torts, such as assault and battery, or frauds upon creditors; or in a criminal proceeding. Criminal arrests may be made by an officer, or by a private person, and with or without a warrant. In the latter case it must be shown that a felony had been committed; in either, that reasonable grounds existed for suspecting the person arrested.

Arrianus, Flavius, of Nicomedia, ab.100-ab.170. Stoic philosopher, pupil of Epictetus, whose *Discourses* he reported. He wrote a history of the *Expedition of Alexander* which is highly valued.

Arriaza, Juan Bautista, 1770–1837. Spanish poet and official. *Emilia*, 1803.

Arris. Sharp edge formed by the intersection of two sides of a stone. An arris rail is of triangular section, the two faces being inclined at angles of 45 degrees with the horizontal.

Arrival Curve. Representing graphically the relation of time to the gradual change of effect produced upon a receiving instrument, when any condition or state has been transmitted

from a distance. *E.g.*, the curve may represent the relation of time to the rise of potential in a galvanometer, when the latter is attached at one end of a long conductor, and an electric current is made to flow in at the other.

Arrow-arum. *Peltandra Virginica.* Plant of the natural family *Araceæ*, native of e. N. America.

Arrow Games. The use of the arrow in divination and games is the direct outgrowth of its general use by primitive man, combined with his early appreciation of the importance and relation of the four cardinal points. The origin of many sedentary games may be traced to it. See MEISER GAME, PITCH POT, TAB, PACHESI, and CHESS.

Arrow-grass. *Triglochin maritimum.* Plant of the *Alismaceæ*, native of the northern hemisphere.

Arrowhead. *Sagittaria sagittifolia* and other species

Arrowhead (*Sagittaria sagittifolia*).

of *Sagittaria;* plants of the family *Alismaceæ*, natives of the northern hemisphere.

Arrowroot. *Maranta arundinacea.* Plant of the natural family *Marantaceæ*, extensively cultivated in tropical America for its farinaceous rootstocks, from which starch of

Arrowroot (*Maranta arundinacea*):
A, flowering branch; B, base of flower stem; C, branch of the rhizome.

same name is prepared. It is easily digested and free from irritant effects upon the stomach and intestines. Obtained also from other species of *Maranta*, and from *Curcuma angustifolia*, *Alstrœmeria ligtu*, and *Zamia integrifolia.*

Arrowsmith, AARON, 1750–1823. English cartographer.

Arrowsmith, JOHN, D.D., 1602–1659. Westminster divine; prof. Cambridge 1644. *Tactica Sacra*, 1657.

Arrow-wood. Shrubs of the genus *Viburnum* in N. America; also known as *Laurestinus.*

Arsacidæ. (1) Dynasty of 27 Parthian kings reigning from 250 B.C. to A.D. 226; named from Arsaces I., founder of the kingdom, originally chief of a nomadic tribe. Famous among them were Mithradates I. and II. (2) Dynasty of Armenian kings who reigned from 149 B.C. to A.D. 428; founded by Artaxias I., who was related to the Parthian line. Tigranes I., 96–55 B.C., raised a petty kingdom to a powerful empire.

Arsenals and Armories. The arsenals and armories of the U. S. Army manufacture and supply to the army all the arms, ammunition, accouterments and equipments required for the service, make necessary repairs, and issue the various supplies required to keep the arms and equipments in a serviceable condition. The Arsenals of Construction are Springfield, Mass., Watertown, Mass., Watervliet, N. Y., Frankford, Pa., and Rock Island, Ill. The Storage Arsenals are Allegany, Pa., Augusta, Ga., Benicia, Cal., Columbia, Tenn., Fortress Monroe, Va., Indianapolis, Ind., Kennebec, Me., New York, San Antonio, Tex., St. Louis Powder Depot, Mo., and the U. S. Powder Depot, Dover, N. J. At the headquarters of the various military departments depots are established from which issues are made to troops of those departments. All ordnance is proved at the Sandy Hook Proving Ground. All small arms, swords and sabers are made at the Springfield Armory. The field, siege and sea-coast guns and mortars are made at Watervliet—the plant being capable of producing guns of 16-inch caliber and 120-tons weight. Carriages for seacoast guns, and projectiles, are made at Watertown, as well as all tests of material used in gun construction; 100 seacoast guns and their carriages are now being made by a private company. Small arms ammunition is made at Frankford, and also sights and metallic cases for field guns, and inspecting apparatus. The leather work of army equipments, belts, harness, and carriages for field and siege guns are made at Rock Island.

The arsenals of Europe receive and preserve arms, munitions and equipments that are manufactured either at private or public establishments. Generally they consist of a principal court surrounded by shelter sheds for artillery material, and of buildings containing great halls in which portable fire arms and their accessories are stored; also buildings for the bureaus and personnel of the administration. The workshops for carpentry, wheelwrights, blacksmiths, etc., and repairs in general are arranged in secondary courts, and in isolated positions at safe distances the magazines for powders and explosives are provided.

Arsenals of this kind exist at many fortified places in Europe and at several of the capitals. Among the most important of these are Vincennes, Lille, Berançon, Grenoble, Perpignan and Bayonne in France; the Tower of London and Woolwich in England; Berlin, Kœnigsberg, Neiss, Dantzic and Spandau in Germany; St. Petersburg, Kief and Moscow in Russia; Vienna, Budweiss and Prague in Austria; Turin, Naples, Ancona and Genoa in Italy; Madrid, Seville, Palma and Barcelona in Spain. Besides these, many European States possess arsenals of construction especially devoted to the artillery service, where the material of artillery is fabricated; such as carriages, etc. The most important of these in France are located at La Fère, Douai, Berançon, Grenoble, Rennes and Toulouse. The British arsenal of Woolwich, founded about 1720, is a vast establishment based on the general principle that provision for the production of every kind of warlike store shall be made there, but only to a degree so limited that there shall remain abundant scope for the encouragement of the same class of manufacture by private establishment. And this principle is largely followed by other nations, whence such great establishments as Krupp's at Essen, Germany, are possible. Woolwich not only contains vast magazines of guns, mortars, shells, powder, and other warlike stores, but workshops and skilled artisans by means of which all such stores for both military and naval service from the simplest implements to the heaviest modern breech-loading cannon can be fabricated, inspected, proved, and stored for issue when emergency arises. The arsenal covers about 60 acres.

Arsenic, As. At.Wt. 75. It was first prepared by the Western alchemists in 13th century. When heated to a red heat it burns with a bluish flame; the vapor has the odor of garlic. It combines with many elements directly. Nitric acid and aqua regia oxidize it to the oxide, As_2O_5, or arsenic acid, H_3AsO_4. The element itself is not poisonous. The method most generally used for detecting arsenic or its compounds, is known as Marsh's Test: this consists of getting the substance in solution, and then pouring some of the liquid into a vessel containing pure zinc and pure dilute sulphuric acid. If arsenic be present it will be converted into arsine, the presence of which can be recognized by heating the tube through which the gas is passing, and by holding a piece of porcelain in the flame, when the characteristic "arsenic spots" will be formed. It occurs in nature as native arsenic, not very abundant, and in large quantities as the arsenide, or sulpho-arsenide, of other metals. The arsenical pyrites contain iron with arsenic, or sulphur and arsenic, and are the principal ore, the largest deposits being found in the Hartz Mountains, Saxony, Silesia, and Bohemia. Large amounts of arsenic oxide condense in the flues attached to the furnaces of silver, lead and tin works. The pure sulphide of arsenic is found in nature as orpiment and realgar, but not abundantly enough to constitute it a useful ore.

Metallic arsenic volatilizes just after fusing, and it has therefore to be always obtained by distillation and condensation. The native arsenic, or arsenical pyrites, needs only to be heated in a closed retort to a red-heat, when the arsenic is entirely volatilized. These retorts are fire-clay tubes ab. 6 inches in

diameter by 4 ft. long, placed in two rows in a furnace. The tube projects outside the furnace, where a clay extension is joined to it by means of a sheet-iron pipe. The arsenic condenses inside the iron tube, and is easily scaled off when cold, and sold without further treatment. At Freiberg, 800 lbs. of ore are treated in a furnace in 10 hours, producing 160 lbs. of arsenic. If impure arsenious oxide, as from the dust flues of tin works, is mixed with charcoal dust and treated in the same furnace, the metal distills over in a similar manner. Siemens and Halske have obtained arsenic electrolytically by dissolving native arsenic sulphide in a bath of ammonium, or sodium-sulphide solution, and electrolyzing with insoluble anodes of carbon or platinum and depositing on copper cathodes.

The alchemist Geber speaks of sublimed arsenic (meaning the white oxide) in the 8th century, and Albertus Magnus describes the preparation of metallic arsenic from its oxide in the 13th century.

Arsenic is steel-gray, has metallic luster, is brittle, and volatile at 180° C. without previous fusion. Its vapor is poisonous to inhale. The specific gravity is 5.7, and the specific heat 0.083.

The only important use of metallic arsenic is for shot-metal. Lead, with one-half to one per cent of arsenic, produces more regular spheres than pure lead. No other alloys are in practical use, the general effect of arsenic being to make other metals brittle.

The total world's production of metallic arsenic is probably less than 100 tons a year; its selling price is twenty cents per lb.

Arsenic Acid. H_3AsO_4; made by oxidizing arsenic trioxide with nitric acid. It is a tribasic acid. Its solution in water has a strongly acid reaction. It is an oxidizing agent, and is used as such in the manufacture of aniline dyes.

Arsenical Pyrites. See ARSENOPYRITE.

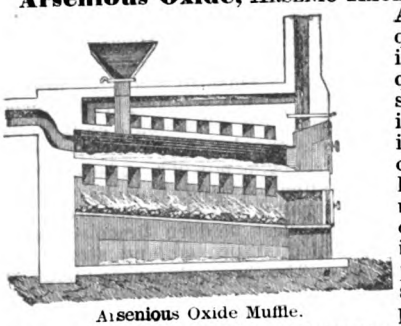
Arsenic Anhydride. See ARSENIC OXIDE.

Arsenic Disulphide. As_2S_2. Occurring in nature as REALGAR (q.v.). It is made artificially by melting together arsenic and sulphur. It is an orange-red powder, sometimes used as a pigment.

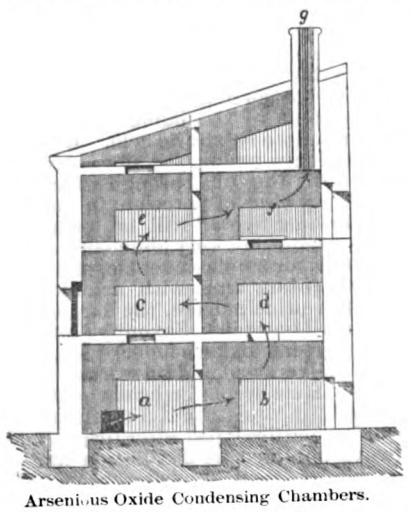
Arsenic Oxide, or ARSENIC PENTOXIDE. As_2O_5. Made by igniting arsenic acid. It is rather unstable at high temperatures, breaking down into the trioxide and oxygen.

Arsenic Sulphide, or ARSENIC PENTASULPHIDE. As_2S_5. It separates as a bright, yellow powder from the solution of sodium sulpharsenate, Na_3AsS_4, upon the addition of acids.

Arsenious Oxide, ARSENIC TRIOXIDE, or WHITE ARSENIC. As_2O_3. Occurs in small quantities in nature. It is manufactured in large quantities by roasting arsenical pyrites, FeAsS. It is soluble with difficulty in water, easily in hydrochloric acid. It is a colorless, amorphous, vitreous mass, which becomes opaque and crystalline in time; or it is a white powder. It has a weak sweet taste, and is very poisonous; a dose of 2 to 3 grains is generally sufficient to cause death. It is used extensively in medicine for strengthening the respiratory organs and for skin diseases. The most efficient antidote is a mixture of ferric hydroxide and magnesia, which forms with arsenic trioxide an insoluble compound.



Arsenious Oxide Muffle.



Arsenious Oxide Condensing Chambers.

Arsenious Sulphide, or ARSENIC TRISULPHIDE. As_2S_3. Occurs in nature as ORPIMENT (q.v.). It is made by heating sulphur and arsenic together, or by passing hydrogen sulphide into a solution of an arsenic compound, when a yellow precipitate is formed. It dissolves in soluble sulphides.

Arseniuretted Hydrogen, or ARSINE. AsH_3. Poisonous, colorless gas, having a disagreeable odor; made by adding a solution of any compound of arsenic to zinc and dilute sulphuric acid. It is unstable when heated; when ignited in the air it takes fire, burning with a pale-blue flame, and forming arsenic trioxide.

Arsenoblasts. Supposed "male" portion of cells; separated as spermatozoa in the testes, or as polar globules on the ovum.

Arsenopyrite. Widely distributed mineral, containing 46 per cent arsenic, 34 iron, and 20 sulphur. It has a metallic luster and a white or grayish color, which sometimes cause it to be mistaken for silver. Its streak-powder is dark grayish black. In hardness it is a little less than quartz. It is frequently found in company with ores of silver, lead, tin, and other metals, and is the principal ore from which arsenic and the numerous arsenical compounds of commerce are obtained. Sometimes it is auriferous and is worked for the gold it contains. It is treated on a large scale in Cornwall and Devon. Considerable quantities are also mined in Silesia, when the mineral is associated with serpentine. It has not been found in paying quantities in the U. S., though it has been worked to a considerable extent in Canada. It is also known as mispickel.

Arsine. See ARSENIURETTED HYDROGEN.

Arsines. Compounds derived from arseniuretted hydrogen (AsH_3) by the replacement of the hydrogen by organic radicals; as methyl arsine, AsH_2CH_3.

Arsinoë, b. ab. 316 B.C. Daughter of Ptolemy I. of Egypt. She married Lysimachus of Thrace 300, her half-brother Ptolemy Ceraunus, and in 279 her brother Ptolemy II., who gave her name to several cities.—Also, a sister of Cleopatra, taken to Rome by Cæsar 46 B.C.; put to death 41 by Antony.—Also, the mothers of Ptolemy I. and II.

Arson. At common law, the willful and malicious burning of another's house, formerly punishable with death. The offense has been extended by modern statutes to the fraudulent burning of one's own house, and has been divided into degrees, with varying punishments.

Art, ORIGIN OF. The earliest art of design was probably developed from the wish (1) to gain such power over animals, in the quest for game, as was supposed to be derived from the possession of drawings or carved figures of them; (2) to obtain similar power over other human beings, and (3) to bring the ancestral spirit or deity into immediate relations with the suppliant for favor, by providing him with an adjacent image as residence. The earliest known works of design are the spirited drawings on ivory and bone of Palæolithic man. To these drawings such magic purpose has been recently ascribed by Lazar Popoff. The same superstition is supposed to have been attached to surface drawing, which, with many savages, relates to the shadow, and identifies it with its original. Many modern primitive cultures have attached such magic power to the picture and the image. Although Egyptian art had attained remarkable perfection at the earliest dates known to us, it was then applied to magical uses. All the early Egyptian paintings of natural scenes and daily life known were tomb paintings, intended to assist the life of the deceased in the spirit world by magical projection. The early Egyptian statues were all simulacra of the dead person placed in the tomb as abiding-place for the spirit, or statues of deities, which again were magically endowed with the life and power of the god. From our knowledge of modern savages, of the oldest known art of a civilized people, the Egyptians, and of the art of Palæolithic man, the conclusion may be drawn that the original use of art was not at all the imitation or copy of living nature as we understand it. Writing has also magical power in the conceptions of primitive peoples. The earliest writing was picture writing, and doubtless the picture was employed for writing at a very early stage of primitive culture; but here again the magic quality was assumed to coexist, and continues to subsist in the conventional derivative hieroglyphic or alphabet characters. It has been proven that, in many or most cases, the patterns of primitive man go back to repeated pictures or carvings of some one design made under the same superstitions. *E.g.*, the entire system of pattern ornament in the Hervey Islands in the Pacific has been traced to carvings of ancestral spirits in guise of the human figure. The entire system of classic pattern-ornament has again been referred to an

evolution from the talismanic repetitions of the Lotus symbol of Egypt.

Artabanus. (1) Brother of Darius, and counselor of his nephew Xerxes. (2) Commander of the body-guard, who assassinated Xerxes, 465 B.C. (3) 4 Kings of Parthia bet. 216 B.C.–A.D. 226.

Artabazus. (1) Persian general of Xerxes. He escaped after the battle of Platæa 479 B.C. with 40,000 men. (2) Satrap of Bactria ab. 330 B.C.

Artaphernes. Persian general of Darius, defeated at Marathon 490 B.C., and of Xerxes in the invasion of Greece, 480 B.C.

Artaud, NICOLAS LOUIS, 1794–1861. French tr. of Sophocles, Aristophanes, and Euripides, 1727–30–32.

Artaxerxes I., LARGIMANUS. King of Persia 465–25 B.C. The Egyptians revolted ab. 460, and were re-subjected ab. 455. —A. II., MNEMON, eldest son of Darius II., king of Persia 405–362 B.C. He defeated the army of his brother, CYRUS, at Cunaxa 401.—His son, A. III., reigned 361–38 B.C., subjugated Egypt ab. 350.

Artedi, PETAR, 1705–1735. Swedish icthyologist.

Artemia. Salt water form of *Branchipus.*

Artemidorus, DALDIANUS. Greek writer of 2d cent. His work on the interpretation of dreams exists.

Artemidorus, OF EPHESUS, ab. 100 B.C. Geographer.

Artemis. Daughter of Zeus and Leto; twin-sister of Apollo; called Diana by the Romans; huntress, sometimes sending plagues and death among men, sometimes relieving their sufferings; a maiden-divinity, unconquered by love; identified with the moon, as Apollo with the sun. She had a famous temple at Ephesus.

Artemisia. (1) Queen of Halicarnassus, who led her troops under Xerxes at Salamis, 480 B.C. (2) Sister, wife and successor of Mausolus, prince of Caria, 352–50 B.C. After his death she mixed ashes in her drinks, and built the mausoleum to perpetuate his memory.

Artemisia. See WORMWOOD.

Artemisium. Promontory at n. end of Eubœa, scene of a 3 days' naval battle between Xerxes and the Greeks 480 B.C.

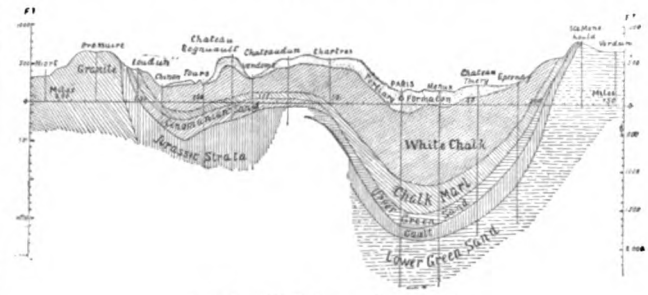
Arterial Pressure. Pressure of the blood in the arteries, which normally should maintain a column of mercury ab. twenty inches high.

Arteries. Tubes which take the oxygenated blood from the heart and distribute it through the body, connecting with the veins by microscopic vessels called capillaries. The largest and most important is the aorta, which springs from the left ventricle of the heart, divides into two common iliac arteries, each of which divides to form the internal and external iliacs, the former of which yields the vesical, uterine, vaginal and hæmorrhoidal arteries. The external iliac passes out of the pelvis, and supplies the thigh, leg, and foot. From the portion of the aorta within the abdomen are given off the inferior and superior mesenteric to the intestines, the renals to the kidneys, in males a branch to the testicle, and in females to the ovary; and the cœliac, which supplies the stomach, liver and spleen. From the arch of the aorta spring on the right side the short innominate artery, which divides into the subclavian and common carotid, which on the left side arise independently from the aorta. The latter ascends in the neck and supplies the brain, eye, and a portion of the nose and skin of the forehead. The external carotid is distributed to the neck, face, tongue, teeth, larynx, pharynx, ear, and most of the superficial parts of the head. The subclavian supplies the fore part of the chest. After reaching the armpit, the clavicular supplies the shoulder, arm and fingers.

The diseases of the arteries are arteritis, atheroma, aneurism, and the degenerations which occur in other portions of the body. They are made up of three coats, an outer, middle, and interior, the latter being sometimes divided into two. Of these coats the middle is the most important, being highly elastic, and serving to maintain the tubular shape of the vessel; when tied tightly it retracts, so that the caliber of the artery is lessened and hæmorrhage more easily controlled. Hæmorrhage from arteries is always serious when the vessel is of any size, and is distinguished by the fact that the blood is thrown out in jets and is of a bright scarlet color; it can be controlled only by tying a thread or cord around them, or by exercising pressure upon the side nearest the heart, *i.e.*, on the body side of a limb.

Arteritis. Inflammation, which may be purulent, of the coats of an artery, due to injury or to obstruction of the flow of blood through it, which may result in its becoming distorted out of shape, its obliteration or atheroma.

Artesian Well. One opened by boring down through a series of strata to a water-carrying bed, inclosed between two impervious layers. These borings were first made in the French province of Artois in 1176. The well at Passy, Paris, is 27½ in. diameter, is 1,923 ft. deep, and discharges 1,980 gals. per minute, the water coming from the lower green sand. The deepest



Artesian Wells in the Paris Basin.

well in the U. S., 3,881 ft. deep, at St. Louis, diameter 4½ in., was a failure. The deepest one in the world, 4,194 ft., is at Sparenberg, Prussia. The water of artesian wells is of uncertain quality, often hard and brackish, owing to the mineral matters in solution.

Artevelde, JACOB VAN, 1285–1345. Brewer of Ghent; popular leader. He supported England against France and the Counts of Flanders; was killed in insurrection, in consequence of his proposal that the son of Edward III. of England should be elected Count of Flanders.—His son PHILIP, 1340–1382, led in the war with Bruges, and was regent of Ghent for a few months, till defeated and slain at Rosbeke.

Arthritis. Inflammation of the structures of a joint; commonly the result of an injury, or one of the accompaniments of a disease, such as gout, rheumatism, gonorrhœa, etc.; best treated by rest, hot and cold applications, and the remedies appropriate for the diseases which it accompanies.

Arthrobranchia. Gills borne on the bases of the legs in lobster-like animals.

Arthrogastra. Group of Arachnids, including *Phalangida, Pseudoscorpionida, Scorpionida, Pedipalpi,* and *Galeodea.*

Arthrology. Branch of anatomy which treats of the joints, articulations, and ligaments.

Arthropoda. Articulated, bilaterally symmetrical, animals with heteronomous segments and with jointed appendages. They have a supra-œsophageal ganglion and a ventral nerve-chain; *e.g.*, Lobsters, Spiders, and Insects. The groups included are *Crustacea, Arachnida, Onychophora, Myriapoda,* and *Hexapoda* (Insecta). The first two are the *Acerata,* the others *Cerata.* The antennæ of Crustacea, etc., are not homologous with those of an insect.

Arthropomata. See TESTICARDINES.

Arthrospore. Spore produced from a bacterium by a metamorphosis of an entire joint or cell, as in the vegetative stage. See SPORES OF BACTERIA.—In botany, bacteria or schizomycetes which do not form internal spores.

Arthrosterigma. Jointed filament of cells in certain lichens.

Arthrostraca, HEDRIOPHTHALMATA, or EDRIOPHTHALMATA. Malacostracous Crustacea with lateral, unstalked eyes, seven or fewer separate thoracic segments, but no fold of the skin forming a carapace. The sub-orders included are *Amphipoda* and *Isopoda.*

Arthrozoa. Group of animals including *Arthropods, Sagitta,* and *Nematoscolices.*

Arthur, ab. 550. Mythical king of the Silures, said to have defeated the Saxons in several battles, and been mortally wounded at Camlan, when fighting against his revolted nephew Modred; hero of the Round Table and of numerous mediæval legends.

Arthur, CHESTER ALAN, 1830–1886. Twenty-first pres. U. S.: collector of N. Y. 1871–78; elected vice-pres. 1880; succeeded to the presidency on Garfield's assassination Sept. 1881.

Arthur, JOSEPH CHARLES, b. 1850. American mycologist; editor of the *Botanical Gazette.* Author of numerous papers on Fungi.

Arthur, TIMOTHY SHAY, 1809–1885. American author of many once popular tales, and founder in 1852 of *Arthur's Home Magazine.*

Arthur, WILLIAM, b. 1819. Irish Wesleyan divine. His *Successful Merchant,* 1852, and *Tongue of Fire,* 1856, were very popular.

Artiad. Element whose valence is expressed by an even number; obsolescent term.

Artichoke. *Cynara Scolymus.* Large plant of the Composite family, native of the Mediterranean region. The axis of the flowerhead is boiled and eaten with melted butter.

Artichoke (*Cynara Scolymus*).

Artichoke, JERUSALEM. *Helianthus tuberosus.* Plant of the Sunflower tribe, natural family *Compositæ*, native of N. America.

Articles of Religion. Name appropriate to all confessions of faith, but applied especially to the 39 Articles of the Ch. of England. Cranmer, Ridley, Latimer and others drew up 42 Articles, which were pub. 1553, and enforced till Mary's accession. Under Elizabeth, 1563, they were revised and reduced to their present shape. They were obligatory at Oxford and Cambridge till 1871. The American P. E. Ch. accepted them, but in 1892 made them an appendix to the Prayer Book.

Articles of War. By the provisions of Section 1342, Revised Statutes. the armies of the U. S. are governed by 128 rules, which every officer must subscribe and every enlisted man swear obedience to, on entrance into the military service.

Articulata. See TESTICARDINES, CRINOIDS, and CYCLOSTOMATA (MOLLUSCOIDEA).

Articulates. All jointed invertebrates, now included in the *Arthropoda* and *Annelida.*

Artifact. Organic structure, the result of artificial processes.

Artificial Draft FOR STEAM BOILER FURNACES. Plan by which the air to support combustion of fuel on boiler grates shall be brought in by some engineering device instead of by the natural draft caused by a warm chimney. Air may be forced into the furnace by a fan, blower, or steam jet, or it may be exhausted by one of the same means at the back or chimney end of the setting. The pressure system has some decided advantages. These methods make the steam user less dependent on atmospheric variations, on size, height, and therefore cost, of chimney stack; the evaporative capacity of the boiler of a given size can be increased, and a kind and size of fuel can be used which it would be difficult to use with chimney draft only. Ab. 250 cubic ft. of air should be supplied per lb. of coal.

Artificial Horizon. Free reflecting surface of a liquid (usually mercury, on account of its high reflecting power) employed for obtaining the altitude of some distant body when the true horizon is not visible. This altitude is half the angular distance between the object and its image reflected in the surface. The angles may be measured with a sextant or theodolite.

Artificial Indigo. Indigo blue or indigoline, prepared from artificial source, usually by the reduction of the orthonitrophenylpropiolic acid. The latter chemical is so expensive that artificial indigo cannot yet compete with the natural product in dyeing, though it finds a limited application in calico printing.

Artificial Limbs. Have undoubtedly been used for many centuries, Herodotus mentioning them; but not until within recent times did they consist of anything but rude affairs of wood or metal. Cork was at one time used to some extent, but at present they are almost exclusively made of papier maché supported by metal, those of American make being by far the best. Their efficiency varies with the length of the stump to which they are attached by means of straps and bands. By the use of springs and pneumatic apparatus hands have been constructed, the fingers of which are made to contract at the will of the wearer, who often becomes very expert in performing the ordinary duties of the hand.

Artificial Stone. Made of sand, cement, and sometimes certain chemicals: Ransome's is made of sand, gravel, silicate of soda, chloride of calcium and water; the chemicals forming silicate of lime, which binds together the grains of sand and gravel. Frear's stone is made of sand, hydraulic cement, gum shellac, and water. The only kinds that have been extensively used are beton and concrete, in which hydraulic cement is the binding material.

Artificial Wants. Desires for such gratifications of the senses as have become habitual, but are not necessary to the preservation of life, *e.g.*, for food of delicate taste, for pleasant odors, for music, and for intellectual stimulus.

Artillery. The projectile machines of the ancients, as catapultæ, ballistæ, etc., for throwing heavy stones, shafts, bolts, and other missiles, had reached great perfection before gunpowder was used in cannon. This discovery, attributed to Schwartz in 1320, marks the epoch separating ancient from modern artillery. Missiles were first projected by gunpowder from cannon at the siege of Quesnoy, France, 1340; from that time on, the development of artillery was progressive. From the 14th to the 17th century the tendency was toward the making of great guns; *e.g.*, that used by Mahomet II. at the siege of Constantinople in 1453, which weighed 18¾ tons, caliber 25 inches, and the wrought-iron "Mons Meg," firing a granite projectile of 330 lbs., used in the siege of Dumbarton Castle 1489, and last fired 1683. During the 17th and 18th centuries, more attention being paid to ease of handling, accuracy and range, the size of guns and projectiles was correspondingly diminished. Starting with these monster guns of the 15th century, cannon were first made of wrought-iron staves hooped with iron rings; but, as the art of casting developed, bronze and cast-iron guns began to appear ab. 1550, and held their ground for near 300 years; then, owing to improved powders and the increasing demand for greater range and accuracy, cast-iron guns, rifled, and hooped with wrought-iron or steel, came into use 1856–1880; finally all new guns since 1880 have been made of steel.

The development in artillery construction which the finished coast-defense gun of to-day exhibits, in comparison with its original type, is due to many mutually assisting causes. The most important of these are, the establishment of artillery schools, where the principles of the art could be formulated and scientifically studied; the necessity arising for better mounting and pointing, and quicker manipulation; the invention by Robins of the ballistic pendulum, leading afterward to other more perfect ballistic machines, whereby the initial velocities of shot and characteristics of gunpowders could be ascertained and bettered; the invention of scientific apparatus for the inspection and proof of guns; the improvements and development of slow-burning powders and of high explosives, from which have resulted the determination of safe strains in gun construction; the improvements in the methods of igniting the charge with greater certainty and celerity; the establishment and arrangement of sights for cannon; and the chambering, rifling and breech mechanism.

The early cannon were nothing more than metal tubes closed at one end; the modern sea-coast gun is built up from a central steel tube, over which successive steel jackets are shrunk so as to bring a previously computed initial pressure on each one within. In this way the gun is enabled to withstand the enormous energy of each discharge and perform the function required of it. The sea-coast guns in the U. S. Service are the 8, 10, 12 and 16-inch B. L. (breech-loading) Rifles, whose weights are 14, 30, 50, and 100 tons, and the 12-inch B. L. Mortar. The immediate supporting carriage for a coast defense gun is designed to combine facility in maneuvering with extreme accuracy in pointing, and, in addition, to protect it from the enemy's fire. The latter desideratum is effected by the use of the hydraulic gun-lift, or the Gordon, Crozier, or other disappearing gun-carriage.

Corresponding improvements have taken place in siege artillery, the resulting armament in the U. S. Service being the 5-inch B. L. Steel Rifle, the 7-inch B. L. Howitzer, and the 7-inch B. L. Mortar.

The efficiency of field artillery depends on the accuracy, power and rapidity of its fire, on the destructive capacity of its projectiles, and on the mobility of its equipment. The field artillery has kept pace in the march of improvement with the great guns. The field batteries of four or six guns can now move with infantry, and the horse batteries can keep up with cavalry. The guns used in the U. S. Service for field artillery are the 3.2 and the 3.6-inch B. L. Rifles and the 3.6-inch Mortars.

Artillery Plants. Herbs of the genus *Pilea*, natural family *Urticaceæ*, natives of tropical regions.

Artillery Position. Location and arrangement by which artillery can be most effectively employed. This depends on its character, caliber and range. Field guns, being mobile, are grouped in one or more batteries and form part of the fighting strength of an army. Their location in battle depends on the

character of the battle, and varies with the attack and defense. Siege guns are of heavier caliber and are located in raised, sunken or half-sunken batteries in front of the parallels or on the flanks of the besieger's works, to give a concentrated fire and interfere as little as possible with the movement of the troops of their own army.

Artillery School. At Fortress Monroe, Va., for instruction of U. S. artillery officers. It has three field officers of artillery, at least five batteries, and an adjutant of the post. The course covers two years.

Artillery, SUBMARINE. See GUNS.

Artiodactyla. Even-toed Ungulates, also known as *Paridigitata;* hoofed mammals with the inner toes absent, the 3d and 4th digits evenly developed and resting on the ground, and the remaining toes more or less rudimentary are systematically placed laterally to the middle pair. When horns are present they are paired, and always have a bony core. There are 19 dorso-lumbar vertebræ, and the stomach is more or less complex. Canines and incisors are often absent in the upper jaw. Adjacent metapodials are sometimes ankylosed to form one "cannon-bone." According to the character of the teeth, there are two sections, the BUNODONTIA and SELENODONTIA (q.v.).

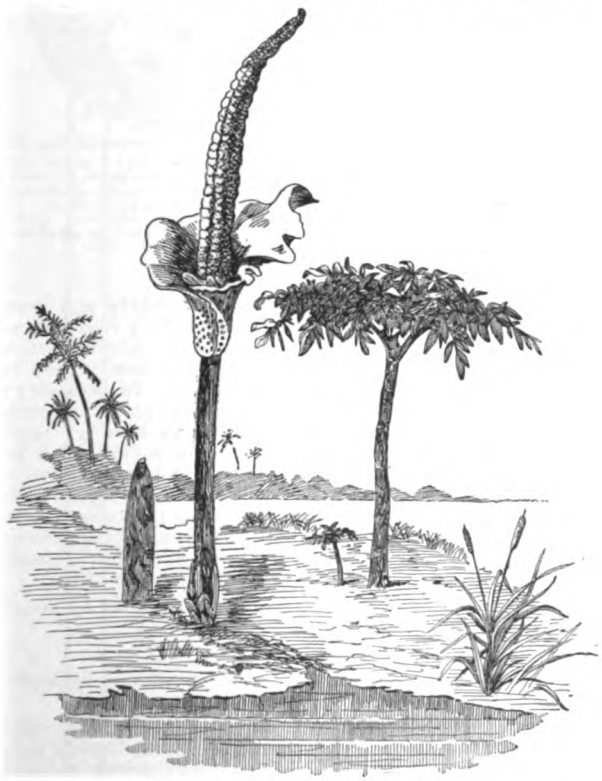
Artisan. Workman in any trade or handicraft, owning the tools with which he works or a part of them; distinguished from mere laborers and from employers.

Artisia. *Sternbergia;* fossil pith of *Conifers* found in the coal measures.

Art, MILITARY, or ART OF WAR. This has for its object, first, to determine the time, place and character of battles that will result most favorably in case of victory and least injuriously in case of defeat, and second, to make one's self stronger than the enemy at the time and place of actual combat. It comprises strategy, grand and minor tactics, logistics, and military engineering.

Artotype. Process for reproducing pictures from nature and art objects on a bichromated gelatin film, suitably prepared, on which a photographic image is imprinted, from which, by proper treatment, an impression can be taken on a printing-press in permanent inks, somewhat resembling a photographic print in quality and character. See PHOTOGELATIN.

Arum. Numerous species of plants in the natural family



Giant Arum (*Amorphophallus Rivieri*).

Araceæ, bearing their flowers on spadices generally more or less inclosed by a spathe, as in the Calla.

Arum, WATER. *Calla palustris.* Beautiful white-flowered herb of the natural family *Araceæ*, native of bogs in the cooler portions of the n. temperate zone.

Arundel Marbles. Antique statues, busts, inscribed marbles, altars, etc., collected in the Levant, 1624, by the Earl of A. Given to Oxford University by his grandson 1667. Include *Parian Chronicle*, inscription of events of Greek history 1582–264 B.C.

Arundel, THOMAS, 1353–1413. Bp. of Ely 1373, abp. of York 1388, and of Canterbury 1396; five times Lord Chancellor; persecutor of the Lollards. He sentenced LORD COBHAM (q.v.) to the stake.

Arundinaceous. Reed-like plants.

Aruspices. See HARUSPICES.

Aruwimi. Branch of the Congo River, in n. e. part of Congo Free State.

Arvales Fratres, or ARVAL BROTHERS. College of twelve priests in ancient Rome, who celebrated the Ambarvalia and other rites connected with rural divinities. Their chief shrine was in a grove not far from Rome, where some interesting inscriptions have been found.

Arvieux, LAURENT CHEVALIER D'. 1635–1702. French consul at Aleppo 1679–86. *Customs of the Arabs*, 1717; *Memoirs*, 1735.

Arwidsson, ADOLF IWAR, 1791–1858. Finnish scholar, exiled 1822; royal librarian at Stockholm; tr. *Frithiof's Saga.*

Aryabhatta. Hindoo mathematician, probably of 5th century, author of the earliest known work on Algebra.

Aryans. In one view, a great division of the human family, known also as Indo-European, or Indo-Germanic, comprising all the nations of Europe, except the Magyars, Basques, Finns, and Turks; and of Asia, the Armenians, Afghans, Persians, and inhabitants of n. Hindostan. The theory that all these nations are derived from a common stock is founded on the affinities of their languages. From the nature of the words common to them, it appears that the people from which they all sprung was acquainted with agriculture, built houses and towns, respected the family relations, and had an organized government. There are grounds for believing that its original seat was in central Asia; that the first stream of emigration flowed through Asia Minor and across the Hellespont, while the second moved around the northeast of the Caspian, and the remnant finally passed through Armenia and Persia into the Punjaub. Recent philologists incline to restrict the name to the older group represented by the later Sanscrit and Old Persian. Aryan was originally a national name; in later Sanscrit it signifies "of good family." See SEMITIC LANGUAGES.

Aryballos.

Aryballos. Ancient Greek vase having a small neck ending in a broad flat rim with small aperture.

As. Ancient bronze coin, the unit of value in Rome and Italy. It originally weighed a pound, but this was reduced first to a third, and lastly to a twelfth.

Asa. Third king of the house of David after Solomon, reigning over Judah ab. 956–915 B.C.

Asafetida. Gum resin obtained from the roots of various species of *Ferula*, herbs of the Carrot family, especially the species *F. fœtida*, and the *Narthex asafœtida*, natives of the East, where, notwithstanding its offensive odor, it is extensively employed as a condiment, as anciently by the Romans. Is used in medicine in hysteria, convulsions, constipation with accumulation of wind, and infantile colic.

Ferula asafœtida.

Asaph. Jewish musician, a teacher of King David's choir, and reputed author of several psalms.

Asaph, ST. City in Flintshire, Wales; site of a small cathedral. Pop., 14,000.

Asaphus. Large Trilobite with smooth surface and somewhat indistinct characters; found in the Ordovician rocks.

Asarabacca. In England, *Asarum Europæum*, a low plant of the natural family *Aristolochiaceæ;* in N. America species of the same genus, also known as Wild Ginger.

Asarabacca (*Asarum Europæum*).

Asbestos, OR ASBESTUS. Fibrous varieties of several different minerals, which possess the property of withstanding ordinary high temperatures without change, though the fibers are fusible in the blowpipe flame. As originally used by mineralogists, the word was limited to the fibrous varieties of the anhydrous metasilicates, amphibole and pyroxene; but the asbestos of commerce is now largely the fibrous variety of serpentine, known as chrysotile. The mineral is found along the Appalachians from New England to Georgia, in the Rocky Mountains, and in California, but of late the principal supply has come from Canada. The best Italian asbestos has a longer fiber than the Canadian, and for laboratory use commands a higher price. It is used for covering steam pipes, for filtering acids, and in naval architecture for fire-proof purposes; in combination with tallow it makes the most efficient gas-checking material for heavy ordnance.

Asbestos Roofing. Thick paper-like felting, used for roof sheathing, and linings of rooms where high temperatures are needed; also for linings of safes.

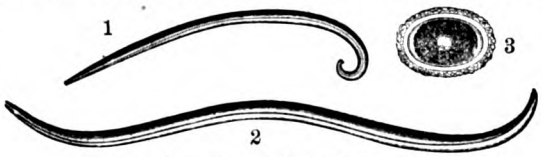
Asbjornsen, PETER CHRISTEN. 1812–1885. Author of *Norwegian Folk-tales*, 1842; *Fairy Tales and Folk-lore*, 1845.

Asbury, FRANCIS, 1745–1816. Methodist missionary. He came to America 1771, and was elected bishop 1784; arduous in travel and labor. His *Journals* were pub. 1852.

Ascalon. Ancient city of Syria, taken by the Crusaders 1099, 1153, and 1192. Its defenses were destroyed by Sultan Bibars 1270.

Ascanius. Son of Æneas and Creusa; reputed founder of Alba Larga; sometimes called Iulus, and regarded as founder of the Julian gens at Rome.

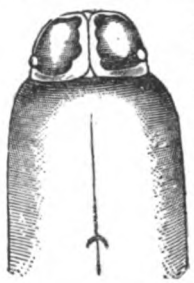
Ascaridæ, NEMATODA. Worms with stout body, and bearing three lip-like papillæ, at the head end; *e. g.*, the round worms (*Ascaris lumbricoides* and *Oxyuris Vermicularis*), parasitic in



Ascaris lumbricoides. 1, Male; 2, female; 3, egg.

the intestines of man, and the *Ascarides*, parasitic in the blood-vessels of the horse. The eggs develop in damp places and the embryos probably get into some intermediate host before they attain their sexual stage. *A. Lumbricoides* resembles the earth-worm in appearance, is sometimes a foot or more in length, and inhabits the small intestine, though occasionally it reaches the stomach and is vomited. It gives rise to colic, diarrhœa, and, rarely, convulsions, and is easily expelled by santonin and cathartics. The *A. Mystax* is smaller, and is most common in cats, but sometimes found in man.

Head, dorsal view.



Head, ventral view.

Ascension Day, or HOLY THURSDAY. Observed from the Apostles' time to commemorate Christ's return to Heaven. It is the fortieth day after Easter.

Ascension Island. In the s. Atlantic, belonging to Great Britain; area 35 sq. m.

Asceticism. Self-mortification, especially in the forms of fasting and flagellation, intended to subdue the lower nature to the higher. It existed among Jews and pagans long before our era, was prevalent among Christians from an early date, and still exists in the R.C. and Eastern Churches, as well as among Buddhists and Brahmans. Protestant doctrine has rarely favored it; but its roots are in human nature.

Ascetta. See ASCONIDÆ.

Ascham, ROGER, 1515–1568. "Father of English prose," and secretary or tutor to Queens Mary and Elizabeth. *Toxophilus, the School of Shooting* (archery), 1544; *The Schole Master*, 1571.

Aschbach, JOSEPH, 1801–1882. Prof. at Bonn 1842, and Vienna 1853; historian of *The Visigoths*, 1827; *The Omeyyades in Spain*, 1829–30; *The Emperor Sigismund*, 1838–45; and *The Univ. of Vienna*, 1865–88.

Asche, RABBI, b. 353. Principal editor and projector of the Babylonian Talmud. It was completed by his pupils.

Ascherson, PAUL FREDERICK AUGUST, b. 1834. German botanist, custodian of the royal gardens at Berlin. *Flora der Brandenburg*, 1866.

Ascidia. Leaves of Pitcher-plants. They are of the nature of phyllodia, the petiole becoming a hollow structure, which serves as a vessel of maceration to the bodies of insects or other animals which have fallen or crept in.

Ascidiacea (CADUCICHORDATA). Section of the *Tethyoidea*, containing the groups *Simplicia*, or *Ascidiæ simplices*, and *Composita*. The latter is divided into the *Sedentaria* or *Ascidiæ compositæ*, and the *Natantia* or *Ascidiæ salpæformes*.

Ascidians. *Ascidiæ simplices*, or simple Ascidians, comprise solitary and social forms, the latter united by branched

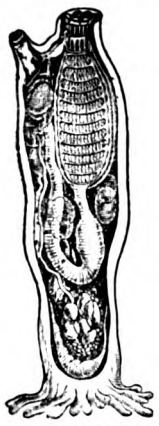


Fig. 1.

Structure of a simple Ascidian, showing inhalent aperture, leading into respiratory pharynx; looped alimentary canal, opening along with genital duct into cloacal chamber; nerve ganglion between inhalent and exhalent apertures; reproductive organs near the base, eggs in body-cavity, etc.; heart at very base; fixing processes.

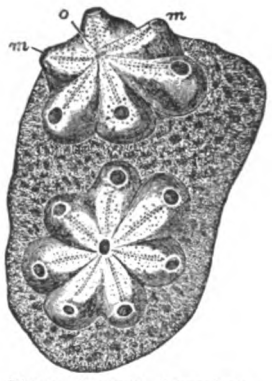


Fig. 2.—Compound Ascidian.

Rosettes of 6 or 7 united individual, with separate inhalent, but united exhalent apertures; *m*, the inhalent aperture; *o*, the common exhalent apertures. The colonies are attached to a piece of seaweed.

root-processes. The testa of the former is warty and opaque, of the latter hyaline, like cartilage. *Clavellina* represents the latter, and *Ascidia* or *Cynthia* the former. *A. compositæ* are small forms united in masses by a common mantle, and having a sponge-like or incrusting appearance. In *Botryllus* the individuals are grouped in star-like clusters about a common exhalent orifice. *A. salpæformes* are free-swimming, thimble-shaped colonies, the hollow of the thimble serving as a common exhalent osculum. The egg develops, in an ovarian sac, into a cyathozoöid which in turn produces, by budding, four ascidiozoöids (sexual forms). These produce the colony by budding from a stolon at the hinder end of the endostyle; and each individual zoöid, as it develops, contains one egg. *Pyrosoma* (named from its phosphorescence) represents this order.

Ascidiarium. Colony of Ascidians, produced by budding from a single original individual.

Ascidioida. See TUNICATES.

Ascidiozoöid. One of the zoöids produced by budding from a cyathozoöid. See ASCIDIANS.

Ascites. Accumulation of fluid in the abdominal cavity, giving rise to a painless enlargement of the abdomen; caused by diseases of the heart, liver, and kidneys, which prevent a free return of the blood from the intestines, and tuberculosis of the peritonæum. It is usually relieved by measures directed to the cure of the disease causing it, and by tapping.

Asclepiadeæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising 204 genera and ab. 1,700 species, distributed throughout the warmer parts of the earth; the Milkweed family.

ATLANTIC OCEAN
N. AMERICA
Behring Strait
ST. LAWRENCE OR CLERK I.
ST. MATTHEW I.
G. of Anadir
KAMCHATKA OR BEHRING SEA
ALEUTIAN IS.
ARCTIC CIRCLE
SHETLAND IS.
ORKNEY IS.
IRELAND
SCOTLAND
ENGLAND
North Sea
LONDON
PARIS
FRANCE
NORWAY
SWEDEN
STOCKHOLM
Gulf of Bothnia
DENMARK
BALTIC SEA
BERLIN
PRUSSIA
RUSSIA
EUROPE
ASIA
Riga
ST. PETERSBURG
Moscow
Warsaw
VIENNA
AUSTRIA
Adriatic Sea
Trieste
Odessa
Sea of Azof
CRIMEA
BLACK SEA
Sea of Marmora
CONSTANTINOPLE
TURKEY
MEDITERRANEAN SEA
Alexandria
Cyprus
Tarsus
Aleppo
Damascus
Jerusalem
Dead Sea
Suez
Cairo
EGYPT
Caspian Sea
Astrakhan
Tiflis
MT. ELBURZ
MT. CAUCASUS
PERSIA
Teheran
Ispahan
Yezd
Persian Gulf
ARABIA
Mecca
Medina
Jiddah
Red Sea
Suakin
Khartoum
ABYSSINIA
Aden
Gulf of Aden
Berbera
Zeyla
SOCOTRA
Ras Hafoon
Hadramaut
ARABIAN SEA
MANCHOORIA
Nerchinsk
Nikolaevsk
Okhotsk
SEA OF OKHOTSK
SAGHALIEN
Kurile Str.
KURILE IS.
ONEKOTAN
YESSO
Hakodate
JAPAN
ISLANDS
SEA OF JAPAN
Nee-gata
Sendai
Yokohama
YEDDO
Simoda
Broughton B.
Corea Strait
YELLOW SEA
Ping-tai
OKI IS.
SIKOK
FATSIO
Kiusiu
Nagasaki
C. Chichakoff
Van Diemen Str.
BONIN IS.
EASTERN SEA
Shanghae
Nankin
Kiang
Amoy
FORMOSA
Canton
Hong Kong
Macao
HAINAN
Bashee Chan.
BABUYAN IS.
C. Engano
LUZON
PHILIPPINE ISLANDS
CATANDUANES
SAMAR
LEYTE
MINDORO
MANILLA
Cavite
PARACEL IS.
CALAMIANE IS.
PANAY
NEGROS
SEGUEIRAS IS.
MINDANAO
CAROLINE IS.
PELEW IS.
PACIFIC OCEAN
CHINA SEA
PALAWAN
Sooloo Sea
Zamboanga
Davao B.
CAGAYAN
SOLOO ARCHIPELAGO
TULUR IS.
MT. KINI BALU
Celebes Sea
Menados
MOLUCCA IS.
EQUATOR
PAPUA OR NEW GUINEA
Brunei
BORNEO
Sambar C.
CELEBES
Macassar Strait
Molucca Passage
G. of Tomini
XULA IS.
KERAM
BOORO
AMBOYNA
BANDA SEA
KEI IS.
ARRU IS.
TIMOR LAUT
ARAFURA SEA
Macassar
Bonthain
FLORIS SEA
BUTON
SERWATTI IS.
Banjarmassin
JAVA SEA
Samarang
MADURA
BALI
SUMBAYA
FLORES
OMBAY
TIMOR
Coupang
ROTTI
SANDALWOOD
MELVILLE I.
Port Essington
Gulf of Carpentaria
AUSTRALIA
ISLANDS
ASIA
British Miles
0 100 200 300 400 500 600 700 800 900 1000
Geographical Miles
0 100 200 300 400 500 600 700 800 900 1000

Ascocarp. Spore-sac of the *Ascomycetes*, an order of *Fungi*.

Ascococcus. See CŒCUS BACTERIA.

Ascogenous. Bearing asci or spore sacs, as the branches of the mycelium of many fungi.

Ascogone. Cell or chain of cells on the mycelium of the *Ascomycetes*, from which the ascogynous hyphæ originate.

Ascoli, GRAZIADIO ISAIA, b. 1829. Italian philologist; prof. at Milan 1860, senator 1889. *Critical Studies*, 1877.

Ascomycetes. Sub-class of Fungi, distinguished by the formation of their spores in sacs or asci. These spores are called ascospores. The group includes a vast number of widely dissimilar forms, including the Truffles and Ergot.

Asconidæ (ASCONES). Group of calcareous sponges, including Ascetta, a minute vase-shaped sponge; its large central cavity or osculum opens at the top and has its walls lined with flagellated cells and pierced by simple canals.

Asconius, PEDIANUS QUINTUS, 1st century. Roman commentator upon Cicero.

Ascontype. Simplest actual type known of existing sponges. *Ascetta* is an example of the simplest form, and *Sycandra* of a form with radial tubes or a spiral series of zoöids (buds) produced on the side walls. All Ascones have the entire paragaster lined with choanocytes.

Ascula. Embryonic sponge just before the lateral ampullæ and spicules are developed, and while the sponge is in the Proterospongian stage.

Asculum. Now Ascoli; ancient town of s. Italy, scene of Pyrrhus' victory over the Romans 279 B.C.

Ascus. Sac or sporocarp within which spores are produced by cell division, as in various fungi and lichens.

Asexual Reproduction. Production of new organisms from parent forms without the union of sexual cells. It is the principal method of multiplication among lower organisms, and occurs either as parthenogenesis, or as budding, division, gemmulation, and sporulation. See GEMMATION, FISSION, SCHIZOGONIA, MONOGENESIS.

Asgard. Fortress of the Asir, or Norse gods, accessible only by the rainbow-bridge; equivalent to the Greek Olympus.

Ash. Trees of the genus *Fraxinus*, natives of the n. hemisphere, belonging to the Olive family.

Branch of European Ash (*Fraxinus excelsior*): *a*, fruit.

Ashanti. Tribe of negroes inhabiting the Gold Coast of w. Africa, noted for their Grecian features, black skin, intelligence, skill as artisans, and semi-civilization. The king is all-powerful, the whole tribe are his slaves. They believe in immortality, but have no developed religious system. The king has a large harem, and body-guard of 1,000 who are put to death on the death of their chief. They were at war with the British 1873–4.

Ashburner, CHARLES ALBERT, 1854–1889. American economic geologist to whose labors the second survey of Pa. owes much of its value, especially in connection with the study of the anthracite coal region and the petroleum-bearing rocks.

Ashburton Treaty. Signed Aug. 9, 1842, at Washington, by Lord Ashburton and Daniel Webster as plenipotentiaries. It defined the boundaries between Canada and Maine, and provided for the extradition of criminals.

Ashby, TURNER, 1824 1862. General C. S. A., killed in Va.

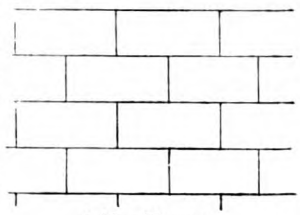
Asher. Eighth son of the patriarch Jacob, and ancestor of one of the twelve tribes of Israel.

Asherah. Images and pillars of wood, perhaps representing the Phœnician goddess Ashtoreth; probably phallic symbols. The word in O. T. is wrongly translated "groves."

Ashes. Useful as adding to the soil whatever of mineral matter the plant had taken from it. As a fertilizer the ashes of hard wood, particularly, furnish a considerable amount of potash and some phosphoric acid. Coal ashes add very little fertilizing material to the soil.

Asheville. City of Buncombe Co., N. C., on French Broad R. at mouth of the Swannanoa, among the mountains; a noted summer resort. Pop., 1890, 10,235.

Ashlar Masonry. Composed of stones which are squared and have smoothly dressed beds and joints; used for the best class of work, and costing from $8 to $15 per cubic yard.



Ashlar Masonry.

Ash-leaved Maple. Small tree of the Maple family, *Negundo aceroides*, or *Acer Negundo*, native of N. America; also known as Box Elder.

Ash, MANNA. *Fraxinus Ornus.* Small tree, native of the Mediterranean region, yielding the substance called Manna.

Ash, MOUNTAIN. *Sorbus Aucuparia* and *S. Americana.* Small trees of the natural family *Rosaceæ*, natives of the northern hemisphere. The berries contain an unfermentable sugar, sorbite.

Ash, PRICKLY. Shrubs and small trees of the genus *Zanthoxylum*, natural family *Rutaceæ*, natives of warm and temperate regions. The e. N. American, *Z. Americanum*, is also known as Toothache-tree.

Ashtabula Bridge. On Lake Shore R. R. in Ohio. It failed Dec. 20, 1876, while an express train was passing, causing the death of 87 persons out of a total of 158 on board. This was the most fatal bridge accident that has occurred in the U. S. An investigation showed that the structure was improperly designed.

Ash Timber. Light, elastic and tough wood, extensively used in carpentry; weight per cubic foot 39 lbs.; ultimate compressive strength ab. 7,000 lbs. per sq. inch.

Ashtoreth, or ASTARTE. Planet Venus, feminine counterpart of Baal, the planet Jupiter. These two were the Phœnician idols whose corrupt worship, with that of Moloch, the planet Saturn, especially ensnared Israel.

Ash Wednesday. First day of Lent, on which, in token of penitence, in R. C. churches, ashes are impressed in the form of a cross on the foreheads of the faithful.

Asia. Largest grand division of the earth's surface, forming, with Europe and Africa, the eastern continent. Its line of separation from Europe is artificial, consisting of the low range of the Ural Mts., Ural River, and the Caucasus; connected with Africa by Isthmus of Suez. It extends from near the equator to 78 N. lat., and from 26 to 190 E. long. Area 17,044,194 sq. miles; pop. ab. 825,954,000. Its mean height is estimated at 3,189 ft. In its southern part is the greatest mass of elevation on the globe, consising of a series of great plateaus, culminating in that of Thibet, 15,000 ft. high, capped by high ranges, reaching their maximum in the Himalayas, hundreds of peaks exceeding 20,000 ft. Mt. Everest, 29,000 ft., is the highest point on the earth. This system of elevation passes w. with diminishing height into Persia and A. Minor, and e. and then n. e., gradually nearing the Pacific coast as it becomes lower, until it disappears near Behring Strait. Northward also it descends into the great steppes of Siberia and the tundras of the Arctic shores. The coast line is very irregular, with deep bays and long peninsulas, with meridional trend. The temperature ranges from that of the tropic to that of the frigid zone, and in the interior of the continent the extremes are very great. The independent Asiatic States are Arabia, China, Afghanistan, Japan, Persia and Thibet. The rest of A. is owned or protected by European powers. Russia rules the northern and central to China's frontiers. Turkey's dominions extend s. to Arabia and w. to Persia; England holds India, Burmah, Straits Settlements and Aden; also Cyprus, Ceylon, and Hongkong; France has Anam, Cambodia and Tonquin; Holland holds parts of Borneo, Sumatra, Celebes and Moluccas; Spain has the Philippines, and Portugal Macao. With the ancients and in the Bible, A. signified the western part of A. Minor, the seat of many Greek colonies, afterward a Roman province.

Asia Minor. Old name of peninsula at the w. of Asia, between the Euxine and Mediterranean; now ANATOLIA. An-

ciently the seat of rich and powerful kingdoms, and the scene of many struggles for political supremacy. Its ruins and inscriptions have recently been studied with great gains to our knowledge of its history.

Asiarchs. "Chiefs of Asia;" rich citizens chosen in Ephesus and other cities to provide for and preside at the public games. Acts xix. 31.

Asiphonia, or ASIPHONIDA. Division of Lamellibranchs, including forms having no siphons on the mantle, and with simple pallial line on the shells. Here belong the Oysters (*Ostreidæ*), Scollops (*Pectinidæ*), Mussels (*Mytilidæ* and *Unionidæ*), and Pearl Mussels (*Aviculidæ*). They are grouped into the *Isomya*, *Heteromya* and *Monomya*. Some authors use these terms in a broader sense, including also the families of *Siphoniata*. Variants of these terms are: *Homomyaria*, *Heteromyaria* and *Monomyaria*.

Askew, ANNE, 1521–1546. Protestant martyr under Henry VIII. Though a friend of the queen, she was tortured and burned for heresy, after the king had broken with Rome.

Askos. Classical vase of Greek manufacture, found in Sicily and Italy.

Askos (Molded)—Lion's Head Spout.

Asmai, or **Asmayi** (ABU SAID ABD-EL-MELEK IBN KORAIB EL-ASMAI), 740–830. Teacher of Haroun al-Rashid, author of a history of the kings of Persia and Arabia before Mahomet, and of a romance of great merit, *Antar*.

Asmodeus. Demon in the book of Tobit, who slew the seven husbands of the daughter of Raguel, each on his wedding night; called "prince of demons" in the Talmud.

Asmonœans. Family of Jewish princes, named from Asmonai, ab. 300 B.C., traditional ancestor of the MACCABEES (q.v.). Simon declared the Jews independent 142 B.C. His son, John Hyrcanus I., 135–107, and Alexander Jannæus, 106–78, had the longest reigns.

Asnyk, ADAM, b. 1838. Polish poet and dramatist. *Rienzi*, 1873; *Job's Friends*, 1879.

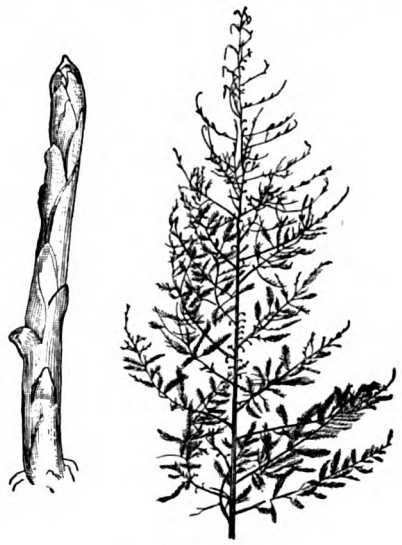
Asp. Venomous serpent of s. Europe and Egypt. The former is the common viper; the other, connected with the story of Cleopatra's suicide, was probably the horned viper.

Naja Haje, Egyptian Asp.

The neck dilates like that of the Cobra, but not in so marked a degree. It is one of the national symbols of Egypt, indicating royal power.

Asparagine. $C_2H_3NH_2.CONH_2.COOH$. Amideamine of malic acid. Prisms easily soluble in hot water. Widely distributed in the vegetable world; found in peas, beans, and asparagus.

Asparagus. *A. officinalis.* Plant of the Lily family, native of Europe, widely cultivated as a spring vegetable.



Asparagus.

Asparagus Stone. $3Ca_3P_2O_8+CaCl_2$. Yellowish-green variety of apatite, found originally in Spain.

Aspasia. (1) Most famous of Greek Hetæræ, mistress of Pericles. (2) Concubine of Cyrus the Younger.

Aspen. Several species of poplar, having leaves with a laterally flattened petiole, causing them to flutter in the light-

Branch of Aspen. *a*, Catkin.

est breeze. The European aspen is *Populus tremula*, the N. American, *P. tremuloides* and *P. grandidentata*. They belong to the Willow family.

Asperifoliæ. See BORAGINACEÆ.

Aspern, BATTLE OF. Near Vienna, May 21 and 22, 1809. Napoleon was defeated by the Austrians, with a loss of some 38,000 to their 20,000.

Asphalt. Partially oxidized petroleum, consisting of carbon, hydrogen, and small percentage of oxygen; liquid and solid, found in nature in many varieties, differing in physical properties and in composition. The region about the Dead Sea is a noted locality. The supply for the e. U. S. comes mainly from a lake in Trinidad in the West Indies. Southern Cal. supplies the Pacific coast demand. The asphalt of France and Germany is a limestone impregnated with bituminous matter. An asphaltic sandstone also occurs in several localities, but its economic value is less than that of the other two varieties. It is mentioned in the Bible as used for mortar in the Tower of Babel; it was used at Ninevah. It is used for coating water-pipes and reservoirs, and for making street pavements. The term is now applied to the solid substance.

The asphalt rock of Switzerland when heated forms a crumbly paste which is spread on the bed of the road and compacted by ramming with iron pestles. The Trinidad asphalt is also used for pavements, it being first mixed when hot with four times

its volume of sand. A concrete foundation from 4 to 6 inches thick is necessary for a durable pavement. These are noiseless under traffic, clean, and usually easy to keep in repair; the first cost is from $2.50 to $3.00 per sq. yard of surface. Artificial asphaltum is obtained as a residue in distilling coal tar and the heavy petroleums of California. The former is called coal-tar pitch and is used for roofing, and the latter is called maltha and is used for coating water-pipes. Both are used in preparing black varnishes.

Asphodel. In England, *Asphodelus ramosus*, plant of the Lily family, native of Syria, and collected in large quantities for its roots.

White Asphodel (*Asphodelus albus*).

Asphodel, Bog. *Narthecium ossifragum* and *N. Americanum*. Plants of the natural family *Liliaceæ*, natives of the northern hemisphere.

Asphodel, False. Plants of the genus *Tofieldia*, natural family *Liliaceæ*, natives of the northern hemisphere.

Asphyxia. Suffocation; condition in which breathing ceases and the supply of oxygen to the blood is shut off. It may be due to hanging, paralysis, drowning, or the inhalation of gases containing an insufficient amount of oxygen to support life.

Aspidella. Supposed pteropod fossil from the Huronian rocks of Canada.

Aspidichthys. One of the huge armor-clad fossil fishes from the Devonian rocks of Ohio. See Placoderm.

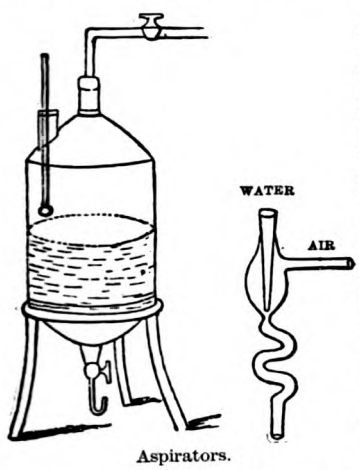
Aspidobranchia. See Rhipidoglossa.

Aspidochirotæ. See Pedata.

Aspidophora (Pterobranchia). Group of Bryozoa, including the marine genus *Rhabdopleura*. It resembles the fresh-water forms, with which it is included in the *Phylactolæmata*.

Aspiration. Operation of removing fluids from any portion of the body, *e.g.*, pus from an abscess, through a hollow needle connected with a small pump; the apparatus is termed an aspirator.

Aspiration Thermometer. Arrangement devised by Belli 1836, and revived by Assmann 1887, for determining the true temperature and moisture of the air at any place and time. The thermometers are inclosed in short tubes, and fresh air drawn rapidly in over them.

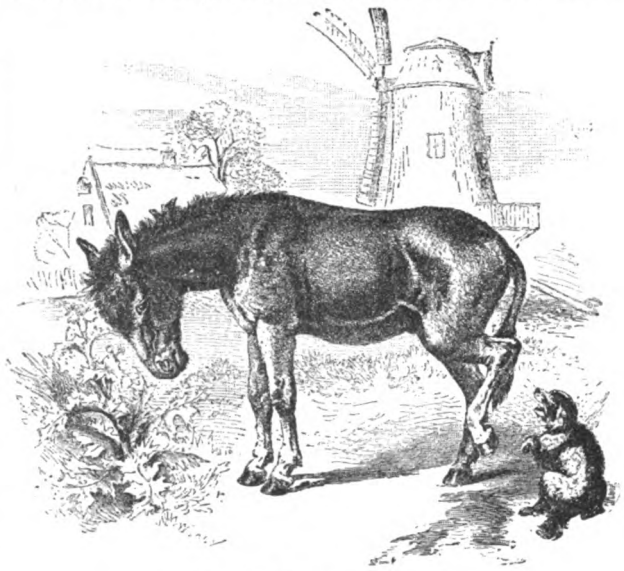


Aspirators.

Aspirator. Apparatus for drawing air through any vessel. One of its forms consists of a cylindrical metal vessel with conical ends, having an opening at the top to which a rubber tube may be attached, and at the bottom a tap. If the vessel be filled with water and the tap be opened, the liquid will run out, thus drawing in air through the tube at the top. An aspirator of this sort is used in connection with different forms of hygrometers.

Aspromonte. Mountain in s.w. Italy, near which Garibaldi and his army were defeated and taken prisoners, Aug. 29, 1862.

Ass. The domesticated and the wild forms are identical, but the former has, in many parts of the world, owing to human neglect and abuse, greatly degenerated in size and grace from the qualities possessed by the wild ass. In Syria, this was the Onager of the ancients. There are several varieties due to breeding in the domestic form, while of the wild form it is believed that one species inhabits Asia, *Equus hemippus* or *E. indicus*, and another one, *E. tæniopus*, is found w. of the Red Sea in Africa. This was domesticated by the early Egyptians, the horse being introduced as late as 1900 B.C. The flesh of the wild species is excellent as food. The cross between a male ass and a mare is a *mule*, which resembles the father most. The stallion and female ass when crossed produce the *hinny*. Probably the first domesticated of the beasts of burden, the ass is practically unknown as such in this country, and is kept only for the production of mules, for



Domestic Ass (*Equus asinus*).

which purpose the largest specimens are most desirable. The male ass is called a *jack*, the female a *jinny*. See Equus.

Assam. Province of Farther India, bordering on China, ceded to Gt. Britain 1826. Pop., 1891, 5,424,190.

Assar, Mohammed. Persian poet of uncertain date, author of the romance *Meher and Musteri*.

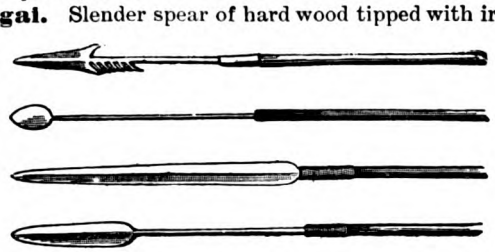
Assassin. Fanatical religious order founded in Persia ab. 1090. The fifth grade, Fedavies (devoted), were candidates of whom blind obedience was exacted; after being intoxicated with hashish, they were sent upon secret commissions. During the crusades they mustered 50,000 men. See Hashish.

Assault. Any action which puts another in instant fear of an unlawful force; if the force is actually applied, it is battery. It is both a civil wrong, or tort, and a crime, and subjects the wrongdoer to an action by the one wronged for damages, and to criminal prosecution. Consent to a battery which amounts to a breach of the peace, or is unwarrantably dangerous, is not a bar to a civil or a criminal action. One wrongfully assaulted is entitled to use such force as is necessary to repel his assailant.

Assay. In coinage, an operation for ascertaining the quantity of precious metal in a mineral, or in coin or bullion. There is an annual official trial of the gold and silver coin of U. S. to ascertain whether the standard of fineness and weight of coinage is maintained. The U. S. gold coin standard is 900 pts. gold, 100 pts. alloy; the limit of difference is one part gold. The silver coin standard is 900 pts. silver, 100 pts. copper; the limit of difference is 3 pts. silver. Limit of error in weight of gold is $\frac{1}{2}$ gr. with eagles, $\frac{1}{4}$ with smaller coins; in mass $5,000 $\frac{1}{100}$ oz.: with silver $1\frac{1}{2}$ grs. and $\frac{3}{100}$ oz. in mass of $1,000.

Assaye. Town of India, where Gen. Arthur Wellesley with 4,500 men defeated Scindia and the rajah of Berar with ab. 40,000, Sept. 23, 1803.

Assegai. Slender spear of hard wood tipped with iron, used



Various forms of Assegais.

by the Zulus and other s. African tribes. Some are used for thrusting, shorter ones are for throwing.

Assemani, Giuseppi Simone, 1687–1768. Maronite from Mount Lebanon, who came to Rome to study and was sent by the Pope to search for manuscripts in the East. He brought back 150, and was made librarian of the Vatican. He pub. *Bibliotheca Orientalis*, 4 v., 1719–28. He was aided by his relatives, Joseph Aloysius, 1716–1782, and Stephan Evodius, 1707–1782, who succeeded him as librarian.

Assemblage OF HEAVY ORDNANCE OR SHAFTING. Shrinkage of the various parts together to form the completed gun or shaft.

Assembly. Court or convention, usually political, as in France 1789–92, and sundry State legislatures; or religious, as with Presbyterian bodies in Scotland and the U. S.

Assessments. Valuations of property as a basis for taxation, or sums charged against property for public improvements thereto; also sums which office-holders are asked to contribute to political campaigns.

Assessor. One appointed in some countries to advise a court; also an officer whose duty it is to make out lists of taxpayers with valuations of their property: in rating property they act in a quasi-judicial character, and are not liable for erroneous valuations made in good faith.

Assets. Property of a person or estate available for debts. Personal assets are those which belong to executor or administrator; real, those which go to the heir. Legal assets may by reached in a court of law; equitable, through a court of equite only.

Assignats. Paper money issued by Government during the French Revolution, based on estates that formerly belonged to the clergy; therefore an assignment of national property, and at first called municipal paper. The first issue was in April, 1790, for 400,000,000 francs; by September, 1792, the amount had increased to 5,000,000,000 fr. The Government sought to maintain their value by reducing the quantity, and 840,000,000 fr. were burned; but not long afterward the need of money was so great that new issues were made, exceeding 20,000,000,000 fr. before 1796. They continued to decline in value until they were abandoned in 1796 and partly replaced by mandats. More than 45,000,000,000 had been issued.

Assignment. Transfer of property by one to another. At common law, things in action were not assignable, but equity generally treated them as declarations of trust and held the assignor as trustee for the assignee; modern statutes frequently authorize such assignments. Negotiable paper is transferable by the customs of merchants. Failing debtors often make assignments of their property to a trustee for the benefit of their creditors; these are generally regulated by statute.

Assimilation. As a mental act, adjustment of an experience to the nature of the mind, or to the totality of past experience; apperception, and closely affiliated with the law of association by similarity: apperceiving the meaning of a fact or the process of making it an organic part of personal knowledge, rather than a mere adjunct from memory.

Assimilation. In plant physiology, processes of the conversion of inorganic to organic matter; constructive metaholism.

Assiniboia. Province of Canada, comprising a portion of the Great Plains e. of the Rocky Mts. Area 95,000 sq. m. Pop. 22,083.

Assiniboine. River of Canada, which drains the s. part of the Great Plains into Lake Winnipeg.

Assisi. Ancient Italian town, birthplace of Propertius, St. Francis, and Metastasio. The Ch. of St. Francis has celebrated frescoes by Cimabue and Giotto. Here is also the fine portico of a Roman temple of Minerva, now the front of a church. Pop. ab. 6,000.

Assizes. Periodical sessions of a judge on certain circuit courts; also court ordinances, and, in Scotland, trial by jury.

Assmann, RICHARD, b. 1850. Assistant in Meteorological Institute, Berlin; inventor of the standard form of ventilated psychrometer.

Associated Press. General News Association of the City of N. Y., was organized 1856 by the Herald, Sun, Times, Tribune, Express, Journal of Commerce, and Courier and Enquirer for the furnishing of news for these newspapers, which divided the expense equally. Other papers paid the Association for news. In 1892 this combination separated and the United Press was formed by the Herald, Times, Tribune and Sun; and the Western Associated Press, Chicago, including also World, Post, Staats-Zeitung and Brooklyn Eagle. These two organizations now supply the news.

Association. In psychology, the suggestion of one idea by another. Our thoughts do not come and go at random, but a relation can usually be detected between a present idea and the one that has preceded it. The principles of association first suggested by Aristotle and elaborated by the English school of philosophers are contiguity in Time and Space, Similarity and Contrast. *E.g.*, a verse of poetry will suggest the following verse, the sight of a friend the place where one last saw him, the hearing of an anecdote one similar or contrasted.

Association. In economics, union of the efforts and interests of many for the same end; leading, as asserted by some, to greater production and more equable distribution than arises from an individualistic system.

Associative Principle. In mathematics, any operation affecting several elements: the relative positions remaining the same, the order in which the subordinate operations are performed does not affect the result:

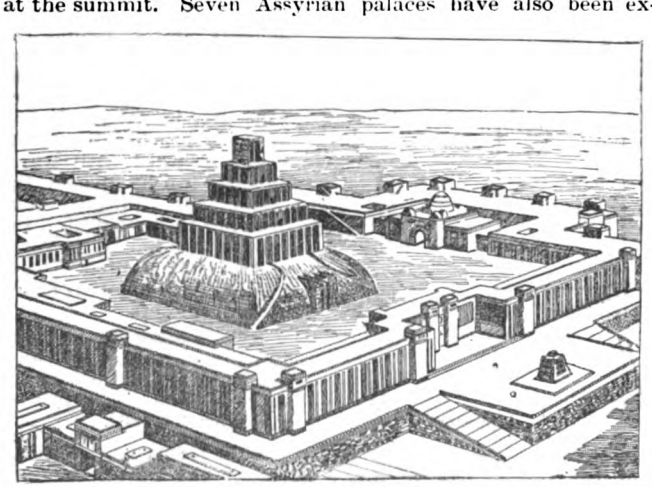
$$(a + b) + c = a + (b + c)$$
$$x.y.z = x.(yz) = (xy)z.$$

Assumption OF THE VIRGIN. Feast held Aug. 15 in the Greek and Roman Churches. It dates from the 6th century.

Assyria. Nineveh was founded from Babylon ab. 2200 B.C. by Asshur, whose name is that of the first seat of government, 60 miles s. of Nineveh, where bricks have been found bearing the names of the earliest kings. Sardanapalus I., whose capital was Caleh (Nimroud), 40 m. further n., founded a magnificent palace, whose remains still exist, and took tribute from the Phœnician cities. His son Shalmanubar defeated Benhadad of Damascus, and afterward Hazael, and received tribute from Jehu, King of Israel. The next monarch, Iva-tush (probably Pul of II. Kings xv.), invaded Palestine, and received tribute from Menahem, King of Israel. The first dynasty, of 18 kings, 1273–747 B.C., ends with him. Tiglath-Pileser II. conquered Syria and carried many Jews captive. Shalmanezer, his successor, attacked Israel, which had been instigated by Egypt to refuse tribute. The next king, Sargon, took Samaria. His son Sennacherib fixed the seat of government at Nineveh, employing 360,000 men to repair the palace, and built a second one, yet more splendid, a portion of which, covering ab. 8 acres, was excavated by Layard. He successfully attacked Babylon, invaded Judea and Egypt, deported 200,000 Jews, and was assassinated by his two sons. The empire declined under Sardanapalus II. Nineveh was taken and destroyed by the Medes and Babylonians ab. 625 B.C. A. was subject successively to the Medes, Persians, Seleucidæ, the Parthian kings (from 312 B.C.); belonged more than once to the Romans; was afterward under the califs; and was wrested from the Persians by the Turks 1638.

Assyrian. Semitic language spoken by the inhabitants of Babylonia and neighboring lands, and related to the Hebrew. Records of it extend far into the past.

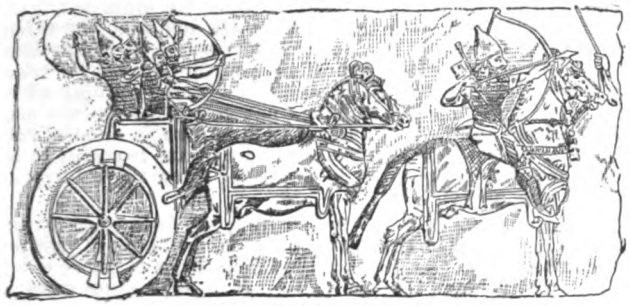
Assyrian Architecture. Nineveh was long marked only by mounds of sand, and remained unknown until 1845, when Botta and Layard began their explorations. These resulted in the discovery of three cities with decipherable remains of vast buildings constructed of sun-dried bricks. Among them ten or twelve have been identified as temples, varying in size and shape, but having a common system of arrangement, composed of a series of receding stories, or terraces, the sanctuary being at the summit. Seven Assyrian palaces have also been ex-



Assyrian Temple.

humed, and are assigned to 900–625 B.C. One, that of Nimroud, which is the oldest, ab. 884 B.C., but not the largest, is nearly a square of 330 feet. A broad stairway leads to the summit, where an entrance, flanked by winged bulls, gives access to a hall 132 feet by 32. Behind this a smaller hall leads to the central court and the private apartments, the rooms being arranged three deep around the court. Sculptured slabs lined the rooms, celebrating the king's feats in war or in the chase. The other palaces are similar in arrangement, construction and decoration, the latter varying in skill according to its date. Colored and enameled bricks and tiles were profusely used. There is

evidence in the ruins that the builders understood the use of the arch, but none that they employed it architecturally, both the actual architecture remaining and the representations of it showing a construction of post and lintel, evidently imitated

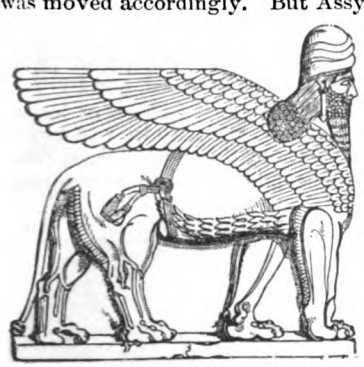


Bas-relief from Palace of Assourbanipal.

from wood-construction, and in its forms tending to establish the Asiatic origin of the Ionic order afterward used in Greece and Rome.

Assyrian Art. Excavations in the Tigris-Euphrates valley were first actively undertaken ab. 1845. The names of Layard, Botta, and Place represent the most important discoveries and publications dating from this era of activity, which in recent years has quite fallen off, until the recent discoveries of De Sarzec at Tello, and Dieulafoy at Susa, and of the American excavations conducted for the museum of the University of Pennsylvania.

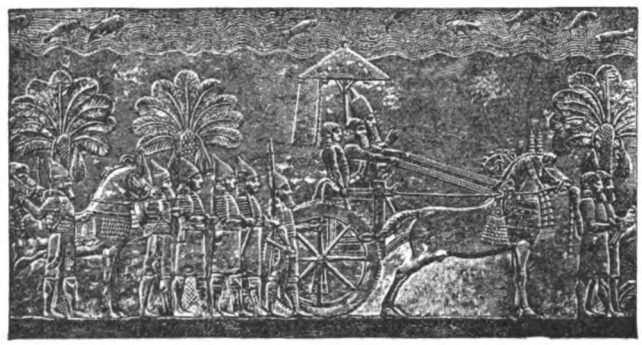
Although the finds at Tello belong to old Chaldean art and those at Susa to the Persian, their relation to the Assyrian must be kept in view. The distinctions largely regard the period rather than the essentials of style. The continuity of art and civilization was unbroken, although different nations successively held the military ascendency, and the center of government was moved accordingly. But Assyrian art was a continuation of the Chaldean, and Persian art was a continuation of the Assyrian. Allowing for differences of date, for historic changes, and for distinctions of race, the art and civilization of the whole Tigris-Euphrates valley had a continuous evolution and general unity of character. In the present lack of satisfactory material for any one period much may be learned from any one to supplement the knowledge of the others. One or two galleries in the Louvre and three or four in the British Museum hold nearly all the acquisitions of Assyrian Art which have reached Europe, either of works of important dimensions or even of minor works. Only the easily portable cylinder seals and baked clay cuneiform tablets would furnish any extensive materials for study in collections outside of those named in London and Paris. In the Tigris-Euphrates valley itself there is an utter dearth of visible ruins or openly accessible remains. Countless mounds containing rare treasures everywhere await the spade of the excavator, but the restrictions of the Turkish government and other causes have made researches almost impossible. No Assyrian cemetery has ever been discovered, and consequently this abundant source of archæologic study in other countries has utterly failed here. It is only in the last few years that the practice of cremation has been demonstrated for Assyria and the dearth of tomb-finds thus partly explained.



The god Nergal (British Museum).

Band of Musicians.

As regards the objects found in and under the palace ruins, the most important are the libraries of eight-sided bricks covered with CUNEIFORM WRITING (q.v.), the bronze pateras or shallow bowls decorated with Egypto-Phœnician designs, and the wing-carvings on placques, which are thought to have been the veneering of thrones or other furniture. Here and there among the ruins are also found roller-shaped cylinder-seals (see ACCAD), and also signet-seals from rings. The most interesting remains of Assyrian art are the low relief sculptures of the alabaster slabs which were used to veneer the brick walls of the palaces. These furnish a wealth of material for

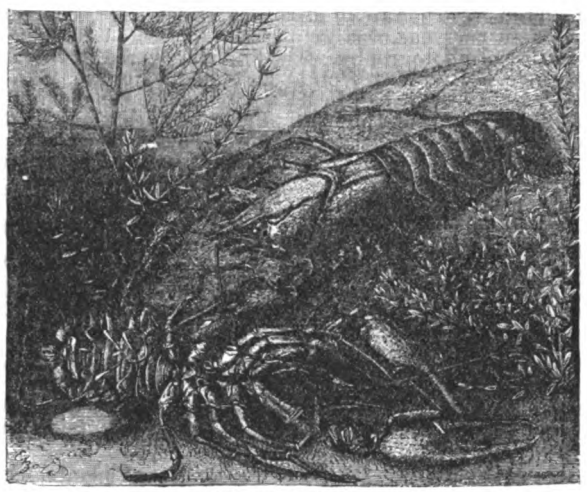


Sennacherib at the head of his Army. (Height, 38 inches—British Museum.)

the daily life, hunting excursions, feasts, devotions, and, above all, the wars, sieges, and military expeditions of the Assyrian kings. In these reliefs, decoration in flat was a controlling idea and perspective was ignored, as usual throughout all periods of ancient surface design; but the design, as regards vigorous action and realistic truth, considerably surpasses the contemporary Egyptian. In certain cases it rises to masterly perfection, especially in the animals and notably the lions.

Assyrian Literary Remains. Inscribed in ab. 300 cuneiform characters upon stone obelisks, slabs, hexagonal prisms, and tablets of terra-cotta in the temples and palaces.

Astacus. Cray-fish, or Fresh-water Lobster. It belongs to the Macrurous division of the decapod Crustacea. The first pair



Astacus fluviatilis.

of walking legs are provided with large chelæ; the second and third pairs are also chelate. See MACROURA and DECAPODA.

Astarte. Syrian Aphrodite (Venus) whose worship came from Cyprus to s. Greece, from the East to Cyprus.

Astatic System. Combination of two magnetic needles mounted parallel to each other a short distance apart so as to rotate freely as a rigid system about a common axis. The similar poles of the two needles point in opposite directions, and their magnetic movements are equal, so that a uniform magnetic field has no directive tendency upon such a system.

Aster. Genus of *Compositæ*, including a very large number of species, some of which are cultivated as garden plants.

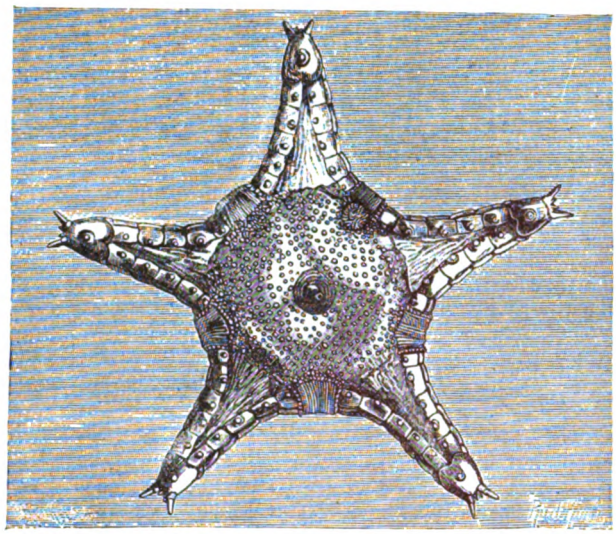
Aster, GOLDEN. Yellow-flowered herbs of the Composite family, natives of N. America.

Asteridea. See ASTEROIDEA.

Asteriscus. Otolith found in the *recessus cochleæ* of fishes.

Asteroidea. Star-fishes; star-shaped Echinoderms having a central disc, from which project radially five hollow arms that contain lobes of the viscera. The integument is leathery and spiny. There is no dental apparatus to the mouth, which is central on the lower surface. The anus, when present,

is at the aboral pole. The ambulacral feet project from grooves on the under side of the arms. Sometimes also the Ophiu-



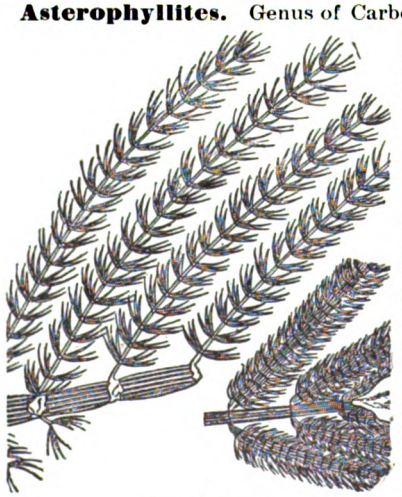
Asteridæ (*Porcellanaster cœruleus*).

roids. The true Star-fishes form the section *Stelleridea* or *Asteridea*.

Asteroids, or PLANETOIDS. Group of small planets whose orbits lie between those of Mars and Jupiter. The first discovered, Ceres, was found by Piazzi at Palermo, Jan. 1, 1801; the second, Pallas, by Olbers, March 1802; the third, Juno, by Harding, 1804; the fourth and largest, Vesta, by Olbers, 1807. No more were found until 1845, when Astræa was discovered by Hencke. Since 1847 every year has seen one or more additions to the number. The rate of discovery, which had been averaging 8 or 10 per year, was greatly accelerated in 1891 by the application of photography. The first discovered in this manner was No. 323, by Max Wolf at Heidelberg, Nov. 28, 1891. In 1891, 22 were discovered; in 1892, 30; in 1893, 26; making the total number at that time 378. From perturbations of Mars Leverrier estimated the total mass of the asteroid system to be one fourth that of the earth; the total number of asteroids must therefore probably be reckoned by millions. The largest is Vesta, diameter estimated between 300 and 400 miles; the smallest discovered probably do not exceed 8 or 10 miles in diameter. Doubtless the system comprises innumerable minute bodies comparable to meteoric stones in magnitude. The most remote is Hilda, distance from sun 366,000,000 miles, period 7 years, 312 days; the nearest Medusa, distance 198,000,000 miles, period 3 years, 40 days.

Asterolepis. Placoganoid fish whose large plates were embossed with star-like tubercles; some species attained the length of 20 or 30 ft.; found in the Old Red Sandstone of Scotland and Russia, and described by Hugh Miller. See PLACODERM.

Asterophyllites. Genus of Carboniferous plants, nearly allied to Calamites, and represented in the present flora by the Equisetums or scouring rushes.



Asterophyllites.

Asterospondyli. See SHARKS.

Asters. Star-shaped spicules in sponges; also the figures formed during karyotinesis, when the chromatic loops radiate from a center.

Asthenopia. Pain and sense of fatigue in the eyes and headache due to their overuse, farsightedness, astigmatism, or anything which throws a strain upon the accommodation, and hysteria. It is relieved by diminished use of the eyes and properly adjusted glasses, but is often difficult and slow to cure.

Asthma. Distressing disease of the lungs, probably of nervous origin, in which the patient is suddenly attacked by great difficulty in breathing, which may continue for a few minutes or for an hour or more, when the spasm of the bronchial tubes, which is the cause of the trouble, relaxes, and the patient is restored to his normal condition more or less exhausted. The disease spares neither sex nor age, but rarely proves fatal by itself; the attacks may occur at intervals of hours, days, or months. A host of remedies have been tried, but none of them are of much avail except for warding off or relieving an existing attack, and what assists one person may fail utterly in another. Change of climate holds out the only hope of permanent relief, but no one climate is useful in all cases, some being benefited by a change from the interior to the seacoast, and vice versa.

Astigmatism. Condition in which the refraction in the different meridians of the eye varies so that one set of rays are brought to a focus at a point behind or in front of those entering the eye in some other meridian. It depends upon unequal curvature of the cornea or lens, and possibly upon some defects in the retina, and is often the cause of headache and pain in the eyes, on account of the severe strain upon the accommodation. To correct it, lenses cut from cylinders, with their axes rotated according to the portion of the field in which vision is indistinct, are used instead of those cut from spheres.

Astomata. Many of the flagellated infusoria as having no differentiated mouth.

Astorga, EMANUELE D', 1681–1736. Sicilian singer and composer of music, especially songs and cantatas. His most celebrated work is a *Stabat Mater* for four voices and orchestra, 1713.

Astor Library. Founded in N. Y. by John Jacob Astor (1763–1848); opened 1853. The original bequest of $400,000 was supplemented by later gifts from a son and grandson. It has ab. 250,000 vols.

Astor, WILLIAM WALDORF, b. 1848. American novelist; Minister to Italy 1882–85. *Valentino*, 1886; *Sforza*, 1889. In 1893 he settled in England, purchased the *Pall Mall Gazette*, and founded the *Pall Mall Magazine*.

Astrachan, or ASTRAKHAN. City of s. e. Russia on an island in the Volga, 30 m. above its mouth. Pop., 1888, 73,710. —Also, fur from sheep raised in Persia, Bokhara, and Syria.

Astræa. Daughter of Zeus and Themis; goddess of justice. She lived with men in the golden age, but withdrew to heaven when men became wicked, and became the constellation Virgo.

Astræidæ. Massive madrepore corals with no cœneuchyma between the fused thecæ. The edges of the septa are serrate, and in Brain Corals (*Meandrina*) the cups are united to form valleys that meander over the surface, like the sulci on the cerebral hemispheres of Man.

Astræa pallida.

Astragal. In Classic architecture, projecting molding of half or more of a circle in section; one of the bars in which a window pane is set.

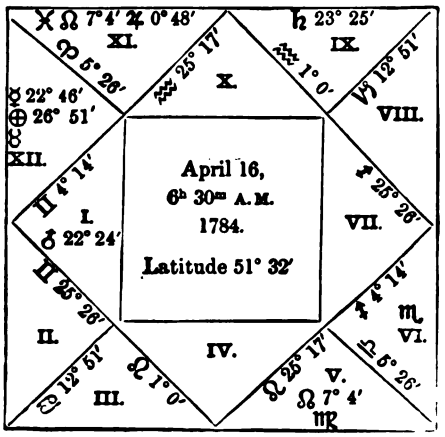
Astragalomancy. Divination with dice or knuckle bones; a custom of remote antiquity, still practiced in India, where it is known as ramala. It has an extensive literature, both Sanscrit and vernacular. Several kinds of dice in the form of square prisms, called pasa, appear to be related to the staves used in divination and games.

Astringents. Substances which contract animal tissues and check hæmorrhage and diarrhœa; *e.g.*, nutgalls, logwood, alum and ferric salts.

Astrolabe. (1) Astronomical instrument invented by Hipparchus, of much the same form as the Armillary Sphere. (2) Instrument formerly used by navigators for measuring the sun's altitude. (3) In astrology, a stereographic projection of the celestial sphere on a plane of a great circle, *e.g.*, the equator.

Astrology. Pseudo science of remote and supposedly Chaldean origin, once in high repute; based on the hypothesis that human affairs were greatly influenced by the positions and aspects of the heavenly bodies, particularly at the time of birth. It is usually divided into two branches: natural, dealing with the motions of the heavenly bodies, eclipses and the like; and judicial, which applies these to predicting human destinies. Though based upon premises utterly false, astrology has in the past rendered important service to science by furnishing an incentive for the study of astronomy when otherwise

it might have been altogether neglected. Traces of its past influence are found in many terms of common use, owing their origin to this source, as jovial, mercurial, saturnine, disastrous. Another survival is the diagram found on the first page of many almanacs, showing the human figure with the signs of the zodiac supposed to preside over the various parts. It deeply engrossed the ancient Mexicans at the time of the Conquest. Their codicils consist of rituals and astrological calculations,



Usual Method, in drawing a Horoscope, of representing the Twelve Houses of Heaven.

which indicate that they must have made continuous observations for many hundred years. Astrology has been relegated among us to quacks and empiricists, but is still seriously practiced in China, where, until recently, the court astrologers were important government officers.

Astronomical Physics. Science which deals with the physical condition of the heavenly bodies. The facts so far deduced are very largely the results of observation with the spectroscope, polariscope, and photometer.

Astronomy. Science which treats of the heavenly bodies, including the sun, moon, planets with their satellites, stars, comets, nebulæ, and meteors. It includes descriptive, spherical, practical, theoretical, and physical astronomy, and astronomical physics. Tracing its development from the first rude notions of which we have any records to the science as we find it to-day, it may be divided into three periods: 1, before Hipparchus; 2, from Hipparchus to Sir Isaac Newton; 3. from Newton to the present day. The first embraces the astronomy of China, India, Chaldea, Egypt, and the earlier efforts of the Greeks. With none of these do we find a true science. In some cases observations were made with great diligence for purposes such as the regulation of the calendar and the requirements of religion and astrology. Also with many ancient peoples the greatest incentive existed for the study of the heavens in the fact that the sun, moon, and other heavenly bodies were objects of worship. The astronomical activity of the Chinese is said to date from the emperor Fou-Hi, 2857 B.C., but the earliest observation of which anything like an authentic record exists was made ab. 1100 B.C. This activity seems to have terminated ab. 480 B.C. Their astronomical work consisted principally in predicting and observing eclipses, determining the positions of the equinoxes and solstices, the obliquity of the ecliptic, and regulation of the calendar.

Our own knowledge is a direct lineal descendant from that of the Chaldeans and Egyptians. With the latter it was entirely in the hands of the priests, who surrounded it with the secrecy and mystery which prevailed in all their religious observances. The Greeks held exaggerated notions regarding the proficiency of the Egyptians in this direction, but little exists in the way of authentic record bearing on the question. The accurate orientation of the pyramids and temples, with some peculiarities in their construction, indicate a considerable acquaintance with the positions and apparent movements of the stars.

That the Chaldeans observed celestial phenomena with great diligence is attested by their discovery, in a purely empirical manner, of the period, called by them the saros, comprising 223 lunations, or 18 years and 10 days. At the end of this period the earth, sun and moon are found in very nearly the same relative positions as at the beginning, and eclipses of the sun and moon follow each other in the same order in successive periods. Thus they were able to predict the future occurrence of eclipses by a simple arithmetical operation.

The early Greeks derived their science from the Egyptians, but in addition to observation, for which in general they had no great liking, they were fruitful in theories and speculations regarding the nature of the universe. It would perhaps have been strange if some of these had not been approximately true. We are in fact told that Pythagoras secretly taught his disciples that the sun was the center of the universe, and not the earth, as commonly supposed. Aristarchus of Samos, 250 years later, seems to have proclaimed the same doctrine openly.

With the advent of Hipparchus a new era began. Besides adding greatly to the existing store of knowledge, he performed the great service of uniting the scattered fragments into a consistent whole, thus raising astronomy to the rank of a true science. The system which he adopted, with its uniform circular motions in epicycles and deferents, though not the true one, as events afterward proved, formed a good working hypothesis, doubtless the best then available. That it answered its purpose admirably is sufficiently attested by the fact that it held possession of the field substantially unchallenged for 1,600 years.

During this long interval no great advance was made. The system of Hipparchus was verified and perfected to some extent; but his immediate successors, though provided with everything then considered requisite at the famous Alexandrian Academy, did substantially nothing. Three hundred years later Ptolemy collected the substance of what was then known in his great work, the *Almagest*, as the Arabians called it, apparently contributing but little original with himself. This work was the universally recognized authority for 1,300 years.

During the Middle Ages the Arabs cultivated the learning of the Greeks. They preserved science alive during this dark period, but their own contributions are almost insignificant.

In 1543 Copernicus proclaimed something like the true theory of the solar system; soon after, Galileo with his newly invented telescope was able to extend enormously the bounds of the visible universe, thereby contributing greatly toward a truer conception of the same; Kepler, by attentively studying the fine series of observations of Tycho Brahe, discovered his three well-known laws; these prepared the way for Newton.

Previous to Newton everything was in a sense empirical. The elaborate mechanism devised by Hipparchus and his successors was evolved from no underlying principle, but was maintained and kept in motion by the higher powers. With Newton all was referred to one comprehensive law, that of universal gravitation. This principle so abundantly proved its truth, not only by accounting for known phenomena, but by foreshadowing others in advance of observation, that it soon triumphed over all opposition.

The further development of the consequences of Newton's great discovery, with its application to the numerous problems of planetary motions and perturbations, fell very largely to the lot of the continental mathematicians; the names of Delambre, Clairant, Euler, Lagrange, Laplace, D'Alembert are familiar.

The advances which have taken place in physical astronomy would have been quite impossible without like advances in the collateral arts and sciences. Elaborate instruments and improved methods were necessary to furnish the accurate observations required for the perfection and refinement of theory. The developments of pure mathematics have at the same time contributed to and been stimulated by the demands of astronomy. The invention of logarithms shortened by half the labor of the almost endless computations. Within very recent times the spectroscope has created what is almost a new science, occupying the borderland of astronomy and physics, that of Astro-physics. Application of photography has already added much to the resources of the observer, with great possibilities for the future; in particular the latter has performed a service not unlike that which would follow a manifold increase in the power of our telescopes, by rendering visible objects otherwise hopelessly beyond the range of vision, for by long exposure the feeble light of distant nebulæ and minute stars impresses itself upon the plate, producing pictures of faint objects and delicate details which no telescope could ever render visible. It is along these lines of spectroscopy and photography that the most rapid advances are now taking place, though what is sometimes called, by way of distinction, the older astronomy, is by no means neglected, and an abundance of unsolved problems still confront us.

Astronomy, DESCRIPTIVE. Plain account of the appearances, motions, and general characteristics of the heavenly bodies.

Astronomy, PHYSICAL. Formerly understood to be an application of the principles of theoretical mechanics to explain the movements of the heavenly bodies; with some recent writers the same as Astronomical Physics.

Astronomy, PRACTICAL. Whatever pertains to the instruments and methods of observation and calculation by which astronomical facts are determined.

Astronomy, SPHERICAL. Application of the methods of spherical geometry and trigonometry to the circles and angles of the celestial sphere.

Astronomy, THEORETICAL. Determination of the orbits of the heavenly bodies, including the perturbations and computation of ephemerides.

Astrorhizidea. Order of imperforate *Foraminifera*, having arenaceous shells, often with radial partial chambers or branches.

Astruc, JEAN, 1684–1766. Prof. of medicine at the Royal College, Paris, from 1731. He was the first to note the different traces of documents, now called Elohistic and Jehovistic, in Genesis. By these observations, pub. 1733, he started the modern critical study of the Pentateuch.

Asturias. Mountainous province in n. Spain, long held by Goths against Arabs; inhabited by a simple people, boastful of their freedom, sometimes called the Swiss of Spain. The Vaqueros form a caste by themselves.

Asuncion. Capital of Paraguay, on the Paraguay River. Pop., ab. 25,000.

Asylum, LAW OF. An independent state is under no international obligation to surrender any person within its exclusive jurisdiction to another state, unless bound by treaty so to do; on the other hand, it is not required to furnish an asylum to refugees from other states; and if the right of asylum is used for the purposes of hostility to a friendly state, it is forfeited.

Asymptote, CIRCULAR. Circle which has its center at the pole of a spiral and lies wholly within or without. It is found with spirals whose radius vector, being greater or less than some constant for all finite values of the vectorial angle, equals this constant when the angle becomes infinite. The constant which is thus the inferior or superior limit of the radius vector is the radius of the circular asymptote.

Asymptote, CURVILINEAR. Two curves are asymptotic when, constantly approaching each other, they meet at no finite point.

Asymptote, RECTILINEAR. Limiting position, passing through finite points, of the tangent to an infinite branch of a curve as the point of contact approaches infinity.

Atacamite. $CuCl_2+3H_2CuO_2$. Copper oxychloride, originally found in the form of sand in the province of Atacama in Chili.

Atahualpa, d. 1533. Last Inca of Peru, executed by Pizarro.

Atalanta. Arcadian huntress, first to strike the Calydonian boar.—In the Bœotian legend, she challenged her suitors to race with her, overtook them and speared them in the back. Hippomenes threw on the ground 3 golden apples given him by Aphrodite; A. stooped to pick them up and so lost the race.

Atamasco Lily. *Amaryllis Atamasco.* Showy-flowered plant, native of the s. U. S.

Atavism. Reversion of a child to the type of an ancestor of its parents, so that traits or characters which have lain latent for some generations, once more appear.

Ataxia. Form of nervous disease in which the power to control the muscles is lost, so that there is difficulty in performing complicated movements. See LOCOMOTOR ATAXIA.

Atbara. River rising in the mountains of Abyssinia, flowing n. w., and joining the Nile above Berber. Length ab. 550 m.

Atchafalaya. Secondary channel of the Mississippi, which it leaves at the mouth of Red River. It enters the Gulf of Mexico 120 m. w. of the mouth of the Mississippi. In time of flood this aids materially in the discharge of the river.

Atchafalaya Bay. On s. shore of La.

Atchison. City of Atchison co., Kan., on w. bank of the Missouri, in e. part of the State. It is an important railroad center. Pop., 1890, 13,963.

Ate. Goddess of infatuation and mischief; banished to earth from Olympus.

Atelectasis. Condition in which the air-cells are collapsed, so that it is impossible for the air to enter them. It may be congenital, as in feeble infants whose strength is insufficient to cause full expansion of the lungs, or acquired, when due to pressure upon the lung or bronchial tubes.

Ateles. See PLATYRHINA.

Ateliers Nationaux. See NATIONAL WORKSHOPS.

Ateliers Sociaux. See SOCIAL WORKSHOPS.

Athabasca. (1) District of Canada, n. of Alberta. (2) Lake which receives the waters of Peace and A. rivers, and is drained by Mackenzie River, there called the Snake. (3) Tributary of the Mackenzie, rising in the Rocky Mts.

Athabascans. See TINNEH and ATHAPASCANS.

Athaliah. Daughter of Ahab and Jezebel; married to Joram, king of Judah. After the death of her son, King Ahaziah, she murdered his children and usurped the throne; later an escaped grandson, Joash, was installed, and she was put to death.

Athanasian Creed. Mistakenly so called; apparently of Western origin, in 6th century; received in the West, not in the East, as Third Œcumenical Creed; disliked by many on account of its supersubtle distinctions and damnatory clauses; retained in the English Book of Common Prayer, but not in the American.

Athanasius, ab. 296–373. Bp. of Alexandria 328; great opponent of Arianism. He was active at the Council of Nice, 325, and steadily maintained its doctrine against heavy odds. Four times banished and often in danger, his life was spent in constant conflict and wandering. His character, services, and sufferings alike have commanded reverence.

Athapascans. Family including many tribes in Alaska, British N. America, Washington, Oregon, California, New Mexico, Arizona, Colorado, Indian Territory and Oklahoma. Present number ab. 33,000; ab. 24,300 are in the U. S. See TINNEH.

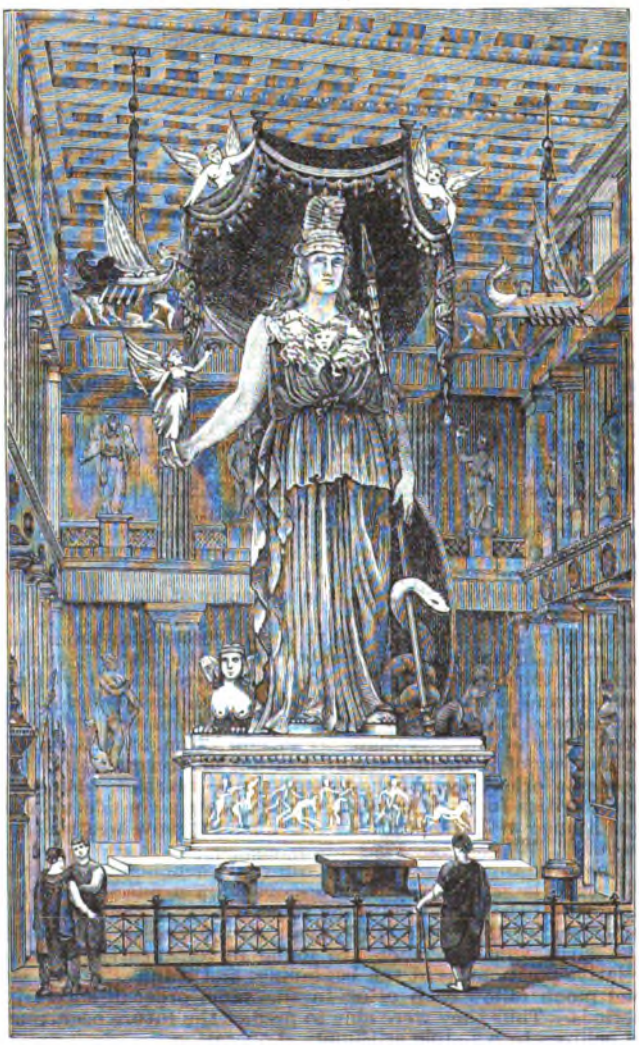
Atharva Veda. One of the four Sanscrit Vedas or sacred books of the Hindoos, believed to be the most recent. See VEDAS.

Athecata. See TUBULARIÆ.

Atheism. Dogmatic denial of God's existence. Term of reproach, flung at the early Christians as deniers of the pagan deities, and constantly misapplied to freethinkers of any sort. "Practical atheism" is living without regard to God's commands, whatever may be one's opinions.

Athelstan, ab. 895–941. First king of all England, 925–940; grandson of Alfred the Great. He defeated the League of Welsh, Scots, and Picts 937.

Athena. Daughter of Zeus and Metis, whom Zeus swallowed. She sprang from his head in full armor; was guardian



Athena in the Parthenon.

of the state, patron of agriculture and the arts, inaccessible to love, goddess of wisdom and of war, and tutelar deity of Athens.

Her symbols are the owl, serpent, cock, and olive-tree. Identified with the Roman Minerva.

Athenæun. School at Rome, founded by Hadrian, with professors for oratory, literature, philosophy and law. It flourished over three centuries.

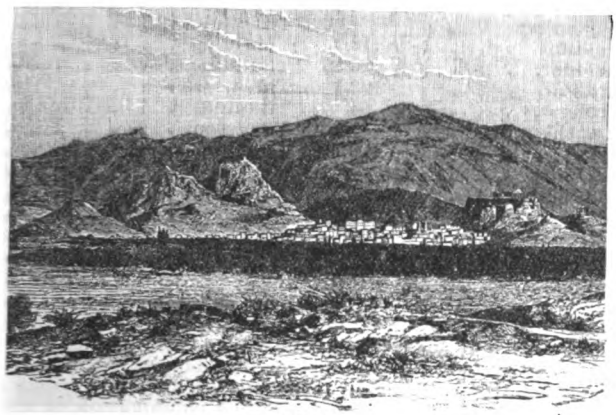
Athenæus, ab. 220 B.C. Author of a work on engines of war.

Athenæus, ab. 200. Greek author, b. at Naucratis in Egypt. We have his *Deipnosophistæ*, or *Banquet of the Learned*, which, in the form of a dialogue, weaves in innumerable anecdotes and discussions.

Athenagoras. Christian apologist; author of a treatise on the Resurrection, and a defense addressed to Marcus Aurelius ab. 177.

Athenry. In Galway, scene of an Irish defeat with loss of 11,000, and almost utter extinction of the sept of the O'Connors, Aug. 10, 1316.

Athens. Capital of Attica, and most famous of Greek cities; said to have been founded by Theseus. Draco's laws, promulgated 621 B.C., were superseded by those of Solon 594. Pisistratus was "Tyrant" 560–527; his sons ruled till 510. A. was at the height of glory in age of Pericles 469–429, and a little later contained 12,000 houses and probably 150,000 inhabitants. A 5-years' plague began 430, and the rule of 30 Tyrants 403. The city submitted to Alexander 335, to Cassander 318; was captured by Sulla 86 B.C., greatly beautified by Hadrian A.D. 122–128, and by Herodes Atticus 161–180. Romans sent their sons here to complete their education. A. was taken by Alaric



Athens.

396, subjected by the Turks 1444; suffered greatly during war of independence 1821–27, and became the capital of Greece 1833. Pop., 1890, 107,251, and of its port and suburb, Piræus, 34,327. Its university, founded 1837, after German models, has 4 faculties with 60 teachers, ab. 1,500 students, and a library of 130,000 vols.

Atheroma. Disease of arteries, in which their coats become softened, infiltrated with fat, and weakened, leading to their rupture, or the formation of an aneurism. The process is usually slow, and, when once established, incurable, but is warded off to some extent by proper food, cod-liver oil, and iron.

Atherton, MRS. GERTRUDE. California novelist. *The Doomswoman*, 1892; *Before the Gringo Came*, 1894.

Athletics. See SPORTS, BASEBALL, ROWING, etc.

Athor. Egyptian goddess, identified with Venus.

Athos, MOUNT. Terminal peak of the eastermost of 3 peninsulas which jut s. e. from Macedonia; 6,350 ft. high and visible from Troy; called "Holy Mountain" by Greeks and Italians. The peninsula contained 180 monasteries in 11th century, and was a famous seat of learning; it has to-day 935 churches, chapels and oratories. The monastic libraries are rich in illuminated and other MSS. The "holy hermits" were here in the 9th century; in legend they date from Constantine. They were pillaged when Constantinople was taken by the Latins 1204; regained prosperity under the Palæologi, but have decayed since 14th century. Some of their holdings in Greece were confiscated ab. 1830; others more recently. The inhabitants number ab. 3,000, all men; no female, man or animal, desecrates the sacred hill. Traces of Xerxes' canal across the isthmus are still visible.

Atkinson, EDWARD. LL.D., b. 1827. American economist. *Industrial Progress*, 1889; *Nutrition*, 1892.

Atkinson, GEORGE F., b. 1859. Prof. Botany Cornell Univ.; writer on *Fungi*.

Atlanta. City of Fulton co. and capital of Georgia, in n. part of the State, at an altitude of 1,050 ft.; begun 1836, incorporated 1847. It is an important railroad center and has extensive manufactures, especially of iron and steel. Pop., 1890, 65,533, much increased since. Here several battles were fought July 20–28, 1864; the city was taken Aug. 2 by Gen. Sherman.

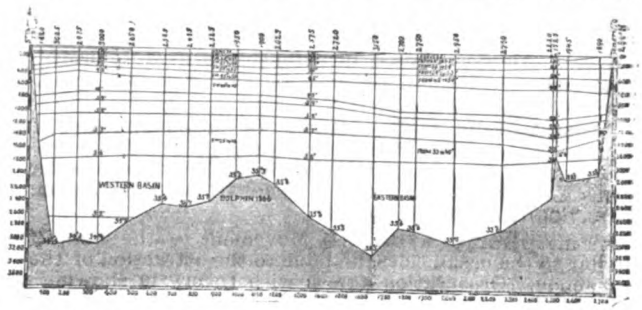
Atlantacea. Group of Heteropods, including forms having a spiral shell, and a well-developed foot, which bears an operculum on the metapodium.

Atlanta Peronii.

Atlantic Cable. The first, completed Aug. 5, 1858, failed at the end of a month; the second was finished July 27, 1866. The French cable was completed, from Brest to Duxbury, Mass., July 23, 1869. The Mackay-Bennett line was laid 1884 from Valentia, Ireland, to Torbay, Nova Scotia. The rates have fallen from $5 a word to 25 cents.

Atlantic City. In Atlantic co., N. J., on a sandy island on the s. e. coast; a well-known summer and winter resort. Pop., 1890, 13,055.

Atlantic Ocean. One of the great subdivisions of the sea, lying between America on the w., and Europe and Africa



Section of N. Atlantic Ocean between St. Thomas and Teneriffe.

on the e. Its area is estimated at 24,536,750 sq. m. Its maximum depth, so far as known, is 4,561 fathoms, and its mean depth ab. 2,250.

Atlantic Plain. That part of the U. S. which stretches from the e. base of the Appalachian Mts. to the Atlantic coast. It is in the main level, though somewhat scored by streams.

Atlantis. Imaginary island w. of the Pillars of Hercules (Gibraltar), described by Plato. Geology affords no foundation for the belief in its actual existence, though much learning, labor, and ink have been wasted in its defense.

Atlantos-aurus. Lizard-footed Dinosaur of the Jurassic of Col., sometimes 100 ft. in length; equal in size to any animal that ever existed on land.

Atlas. Uppermost of the vertebræ, supporting the head, with which it is jointed in such manner to allow of forward and backward movements.

Atlas. Brother of Prometheus; for making war on Zeus with the other Titans, condemned to bear heaven on his head and hands.

Atlas Mts. Range in n. Africa, extending from the lesser Syrtis to the Atlantic. Maximum ht. 13,000 ft.

Atlas Powder. Explosive containing ab. 50 per cent of nitroglycerine, 40 of saltpeter, and 10 of wood pulp; used in blasting.

Atmolysis. Physical analysis by which two gases may be separated from one another by placing the mixture on one side of a porous septum. The separation is due to the fact that the gas having the higher molecular velocity will pass through the septum more rapidly than the other.

Atmometer. Instrument for ascertaining the rate of evaporation from the surface of a liquid.

Atmosphere. Unit of pressure, being the pressure of the atmosphere at sea level. More exactly defined by the International Bureau of Weights and Measures as the pressure of a

vertical column of 760 millimeters of pure mercury under the standard gravity prevailing at sea level and 45° latitude at a temperature of 0 C. See STANDARD GRAVITY.

Atmosphere, EARTH'S. Height ab. 1,000 m. at sea level with a barometric pressure of 30 in. mercury, its weight is 14.7 lbs. on sq. in. of surface. Composition by volume, oxygen 20.93, nitrogen 79.036, carbon dioxide 0.034, with traces of ammonia, nitric acid, and, in towns, of sulphur dioxide and carburetted hydrogen; variable amount of moisture up to 5 per cent by weight.

Atmospheric Absorption. Property possessed by the atmosphere of obstructing and apparently absorbing within itself the radiations that attempt to penetrate it; this causes dark lines or bands in the spectra of the sunlight and starlight, and probably also in the heat radiated by the earth itself.

Atmospheric Conductivity. Conductivity of the atmosphere for heat; this is slight and affects the temperature very little at the earth's surface, but becomes important for the upper, thinner, colder strata, whose specific heat for unit volume is very small.

Atmospheric Moisture. Water contained in the atmosphere, whether in the shape of invisible vapor or visible haze, fog, mist, cloud, rain, snow, or hail; usually restricted to the invisible vapor.

Atmospheric Radiation. Loss of heat from the earth's atmosphere. A small portion of the incident solar heat is stored up in the earth, and a small fraction is radiated into space through the atmosphere, but the larger part must be radiated back by the atmosphere after warming it up.

Atmospheric Railway. Tube in which a train is propelled by the pressure of air. Plans were made 1870 for one under Broadway, N. Y., and a few hundred feet of it were built. Several systems have been proposed, but none has been constructed on a large scale. In Berlin the post-office branches are connected with the main office by pneumatic tubes through which mail is sent on the same principle as an atmospheric railway. Air compressed in cylinders is used to propel passenger cars in Vincennes, France, on a railway 12 m. long, and elsewhere in Europe.

Atmospheric Refraction. Deviation of rays of light from a straight line, due to the varying density of the air. The specific phenomena thus produced are defined under the terms ASTRONOMIC REFRACTION, TERRESTRIAL REFRACTION, MIRAGE, SCINTILLATION, TWILIGHT.

Atmospheric Tide. (1) Movement of the atmosphere similar to the ocean tides, and due to the attraction of the sun and moon. Observation agrees with theory in showing that this tide is so slight as to be barely appreciable in the average of many years' observations. (2) Any atmospheric movement whose periodicity, like that of the ocean tides, depends on the position of the sun and moon. See BAROMETRIC TIDE.

Atmospheric Wave. Any movement of the atmosphere similar to oceanic waves. This term was adopted ab. 1840 by Birt and Herschel in an attempt to explain the irregular rise and fall of the barometer, but is now replaced by the simpler terms, high and low barometer.

Atoll. Coral island, or reef, more or less completely inclosing a lagoon or a submerged island. If the island is visible, we have an encircling reef.

Atom. Smallest portion of matter which can exist or take part in a chemical reaction.

Atomic Heat. Product of the atomic weight of any element by the specific heat of that element, average 6.2. See DULONG AND PETIT'S LAW.

Atomicity. See VALENCE.

Atomic Theory. This assumes that matter is not infinitely divisible; that it is made up of indivisible particles which we call atoms; that when combination takes place between two or more elements, it is the atoms of each which first combine; that the atoms of the same element are alike, and different from those of any other element; and that the atoms of each element have a definite weight which is unlike that of the other elements. These assumptions are made in order to explain the Law of Definite Proportions, that a given chemical compound always contains the same elements in the same proportion, and the Law of Multiple Proportions, that when two elements, A and B, unite to form several compounds with each other, the relative quantities of B which combine with any fixed quantity of A bear a simple ratio to one another. The theory was proposed by Dalton in 1804. It is the fundamental theory of modern chemistry, and is almost universally accepted.

Atomic Weight, or COMBINING WEIGHTS. When sodium combines with chlorine, it does so in the proportion of 23 parts by weight to 35.45 parts of chlorine; when hydrogen combines with chlorine, it does so in the proportion of 1 to 35.45. These numbers are called atomic weights, and mean that the atom of sodium is 23 times heavier than the atom of hydrogen, which is taken as the standard, since hydrogen is the lightest of the elements.

Atomic Weights of the Elements.

Aluminium	27.	Neodymium	140.5
Antimony	120.	Nickel	58.7
Arsenic	75.	Nitrogen	14.03
Barium	137.43	Osmium	90.8
Bismuth	208.	Oxygen	16.
Boron	11.	Palladium	106.5
Bromine	79.95	Phosphorus	31.
Cadmium	112.	Platinum	195.
Cæsium	132.9	Potassium	39.11
Calcium	40.	Praseodymium	143.5
Carbon	12.	Rhodium	103.
Cerium	140.2	Rubidium	85.5
Chlorine	35.45	Ruthenium	101.6
Chromium	52.1	Samarium	150.
Cobalt	59.	Scandium	44.
Columbium	94.	Selenium	79.
Copper	63.6	Silicon	28.4
Erbium	166.3	Silver	107.92
Fluorine	9.	Sodium	23.05
Gadolinium	156.1	Strontium	87.66
Gallium	69.	Sulphur	32.06
Germanium	72.3	Tantalum	182.6
Glucinum	9.	Tellurium	125.
Gold	197.3	Terbium	160.
Hydrogen	1.008	Thallium	204.18
Indium	113.7	Thorium	232.6
Iodine	126.85	Thulium	170.7
Iridium	193.1	Tin	119.
Iron	56.	Titanium	48.
Lanthanum	138.2	Tungsten	184.
Lead	206.95	Uranium	239.6
Lithium	7.02	Vanadium	51.4
Magnesium	24.3	Ytterbium	173.
Manganese	55.	Yttrium	89.1
Mercury	200.	Zinc	65.3
Molybdenum	96.	Zirconium	90.6

Atomism. Theory which reduces all complex organisms and masses of matter to a congeries of small particles or atoms, supposed to be indivisible and indestructible; first advanced by Democritus, and perfected by Lucretius. It was designed to eliminate the notion of intelligence as a *deus ex machina* from the creation of the world's order and organic life; hence all bodies were regarded as the fortuitous combination of these infinitely small particles of matter, which were all alike in kind, and in perpetual motion, and differed only in their size, weight, and shape. The doctrine gave rise to Materialism, and has been its chief support in modern times, though that doctrine is not the necessary conclusion from the ultimate existence of atoms. It has been of great service in the sciences of Physics and Chemistry in explaining the manifold and proportional combination of elements.

Atomizer. Apparatus for reducing any liquid to spray; used in laboratories, hospitals, and in agriculture.

Atonement. Making at one, reconciliation. Man, finding himself spiritually estranged from God, inquires for a means of this. Scripture, while allowing sacrificial atonement in ancient times, declares that a heart surrendered to God is the acceptable sacrifice. As the life, death, resurrection, and intercession of Jesus Christ are the perfect means of closing the chasm between Man and his Maker, He is declared to be our final atonement or propitiation.

Atonement, DAY OF. In Israel, tenth of Tisri or October, when the scapegoat was sent away, and when, alone of all days of the year, the High-priest entered the Most Holy Place, to burn incense and sprinkle the blood upon the Mercy-seat. It is now observed by a rigorous abstinence from food and drink till dark. No other fast is commanded in the Mosaic law.

Atrato. River of Columbia, entering Gulf of Darien. It was proposed to join this river with the Jurador or other rivers which flow into the Pacific, by a canal 48 m. long. This route was abandoned for the Panama route.

Atreus, TREASURY OF. Otherwise called tomb of Agamemnon; at Mycenæ. A beehive-shaped tomb, 50 ft. high, underground, but with an entrance on the level, cut in the side of a hill and carefully walled.

Atrial Canals. Two funnels of the atrial cavity of *Appendicularia*, that open on the surface near the rectum.

Atrial Pore. Opening on the left side into the atrium of

Amphioxus, which serves as an outlet for the generative cells: also the exhalent or excurrent orifice of *Urochorda*.

Atricha. See NEMATORHYNCHA.

Atrides. Sons of Atreus, king of Mycenæ; Agamemnon and Menelaus.

Atrium. Hall or living-room of a Roman house. It was open in the center and the chambers surrounded it. There was

Atrium.

an open cistern which received the rain water. It was used as a public apartment.

Atrium (ATRIAL CAVITY). (1) Chamber into which the intestine opens in Tunicates. (2) Part of the stomach of *Hydromedusæ* into which the radiating canals open. (3) Special peribranchial chamber formed about the ventral part of *Amphioxus*. (4) First division of the heart, which receives the blood, in lower vertebrates and embryos, before it becomes separated into two auricular cavities. (5) Sac connecting ear and air bladders in certain fishes.

Atrocha. (1) Embryo of a polychætous Annelid, having a broad band of cilia around the body, leaving the two ends free, except sometimes a tuft of cilia on the preoral lobe. (2) The wheelless Rotifers.

Atrophy. Diminution in size of an organ or tissue, due to malnutrition or disuse of it.

Atropine. Alkaloid, $C_{17}H_{23}NO_3$, obtained from *Atropa Belladonna*, of which it is the active medicinal and poisonous principle. It is most commonly used in the form of the sulphate, to relieve pain and dilate the pupil in diseases of the eye, and to counteract the unpleasant and poisonous effects of opium, of which it is the physiological antidote.

Atropos. That one of the Fates who bears the shears, and "slits the thin-spun life."

Atta, T. QUINCTIUS, d. 78 B.C. Writer of Roman comedies called *Togatæ* from treating of Roman manners. Fragments remain.

Attacapan Indians. Old tribe in La., named Man-eaters by their enemies.

Attachment. Seizure of property that may be held to satisfy a judgment thereafter recovered; or of a person to compel his appearance in court as a party or a witness.

Attack of a Fortified Place. When a military position is so strongly defended and garrisoned that the prospect of carrying it by an open assault from the nearest position the assailant can reach in force is doubtful, a systematic attack is made, which is technically known as the method by regular approaches; in other words siege operations are undertaken for its reduction. The siege is generally divided into three distinct periods; the *first* comprising all the preliminaries preceding the establishment of the first parallel, the *second* those including the establishment of the third parallel, and the *third*, the works to be executed afterward until the fort is reduced.

Attainder. Extinction of civil rights, caused by judicial sentence of death at common law. The condemned lost all protection of law, his estates were forfeited from the time of the commission of the offense, and his blood was corrupted so that he could not inherit or transmit property. The U. S. Constitution limits the effect of attainder in cases of treason to the natural life of the offender, and prohibits all bills of attainder, *i.e.*, statutes declaring persons attainted without judicial trial.

Attalus. Three kings of Pergamus, in Asia Minor. I., 241–197 B.C.; II., 159–138; III., 138–133. The first two were patrons of literature and art. The third made the Romans his heirs.

Attar or **Otto,** OF ROSES. Yellow essential oil produced in Eastern countries from the Damask Rose. Pure essence is worth $80 to $90 per pound. It requires 300 lbs. of rose petals to make one ounce.

Attention. Concentration of consciousness upon one of the objects within the field of its possible ken. It may be voluntary or involuntary, and involves the partial or complete unconsciousness of objects affecting the sensorium or the mind outside the one occupying thought.

Atterbom, PETER DANIEL AMADEUS, 1790–1855. Swedish poet of the romantic school, prof. Univ. of Upsala from 1828.

Atterbury, FRANCIS, D.D., 1662–1731. Bp. of Rochester 1713; banished 1723 for complicity in Jacobite plots; noted for eloquence.

Attestation. Witnessing the execution of a written instrument, generally by subscribing an attesting clause; not necessary to the validity of a deed at common law, but frequently required by modern statutes in the case of deeds and wills.

Attica. Triangular district of Greece, s. e. of Bœotia; Athens was its capital. Including Salamis, it contained ab. 800 sq. m., with a probable pop. of 500,000, of whom ab. 400,000

Attica.

were slaves. Theseus is said to have united its 12 independent states into one political body.

Attic Dialect. See GREEK LANGUAGE.

Attic Order. With Roman architects, an order of pilasters, or of piers, of which the shafts are square or rectangular in plan.

Atticus, HERODES TIBERIUS CLADIUS, 104–180. Rhetorician of wealth, who built great public works at Athens.

Atticus, T. POMPONIUS, 109–32 B.C. Roman Knight of wealth who lived much at Athens; noted as a friend of Cicero.

Attila, or ETZEL. King of the Huns 434–453; called "Scourge of God." He ravaged both Eastern and Western Empires; invaded Gaul 451 with 700,000 men, and was defeated at Chalons; overran Italy 452, and was persuaded to retire from Rome by Leo I.; d. in Pannonia, and was buried in a secret grave.

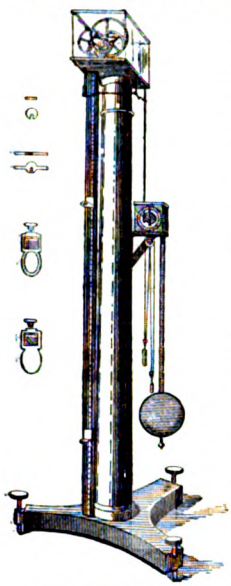
Attorney. One authorized to act for another. He is called an attorney in fact when he acts as an ordinary agent; an attorney at law, when he has legal authority to act for another in the conduct of law proceedings. The qualifications and the admission to the bar of attorneys at law are generally prescribed by statute. They are officers of the court; are bound to act with good faith toward their clients and the court, and are subject to summary proceedings for breaches of this duty. They are liable to their clients for damages caused by their unskillfulness or negligence, and have a lien on their clients' papers or securities in their possession and upon judgments which they obtain.

Attorney-General. Chief official counsel and prosecutor for Government.

Attraction. Mutual action between two bodies, in virtue of which, if they were free to move, they would approach each other. See FORCE.

Attribute. Property of an object, and one of its modes, as contrasted with it as a thing or substance.

Atwater, WILBUR OLIN, b. 1844. American agricultural chemist. A leader in development of agricultural experiment stations in the U. S., first director of the National Office of Experiment Stations, and has made a special study of human nutrition.



Atwood's Machine.

Atwood, or ATTWOOD, GEORGE, 1745–1807. English mathematician and physicist, inventor of Atwood's Machine. *Rectilinear Motion and Rotation of Bodies*, 1784; *Arches*, 1801.

Atwood's Machine. Device for determining the acceleration produced by gravity and for experimenting upon the laws of uniform acceleration. It consists in its simplest forms of a frictionless pulley, over which passes a fine flexible cord; to the ends of this cord are attached two nearly equal masses, P and Q. The effective force which acts downward upon the heavier mass is $Pg-Qg$, and the total mass put in motion is $P+Q$; hence the acceleration $A=\frac{F}{M}=\frac{Pg-Qg}{P+Q}=\frac{P-Q}{P+Q}g$. A is observed by experiment and g calculated from the formula. The advantage of this machine over the direct observation of a freely falling body is due to the fact that in the latter case the motion is much too rapid to be accurately observed. We thus dilute, as it were, the intensity of gravity without in any way changing its laws.

Atys, or ATTIS. Phrygian shepherd beloved by Cybele; unfaithful to her, she maddened him, or, as Ovid says, changed him into a pine tree.

Aubanel, JOSEPH MARIE JEAN BAPTISTE THEODORE, b. 1829. Provençal poet; one of the first felibrés, 1854.

Auber, DANIEL FRANCOIS ESPRIT, 1782–1871. French opera composer distinguished by the gracefulness and elegance of his music and the fecundity of his mind. His first opera was produced 1813; his last 1869. *Le Maçon*, 1825; *La Muette de Portici*, 1828; *Fra Diavolo*, 1830; *Le Cheval de Bronze*, 1835; *Le Domino Noir*, 1837; *Les Diamans de la Couronne*, 1841.

Auber, HARRIET, 1773–1862. English hymnist. Her *Spirit of the Psalms*, 1829, is often confounded with H. F. Lyte's book of the same title, 1834.

Auberlen, KARL AUGUST, D.D., 1824–1864. Prof. at Basel 1851. *Divine Revelation*, tr. 1867.

Aubert, JEAN LOUIS, 1731–1814. Prof. at Paris 1773. *Fables*, 1756.

Aubigné, JEAN HENRI MERLE D', 1792–1872. Church historian; prof. at Geneva 1831. His *History of the Reformation*, 4 vols., 1835–47, was long extremely popular. Its sequel, on the Reformation in Calvin's time, 1862 and later, fills 8 vols.

Aubigné, THEODORE AGRIPPA D'. 1550–1630. Huguenot officer under Henry IV. *Universal History, 1550–1610*, 3 vols., 1616–20; *Memoirs*.

Aublet, JEAN BAPTISTE CHRISTOPHORE FUSEE, 1723–1778. French botanist. *Plants of Fr. Guiana*, 1775.

Auburn. Capital of Androscoggin co., Me. Pop., 1890, 11,250.

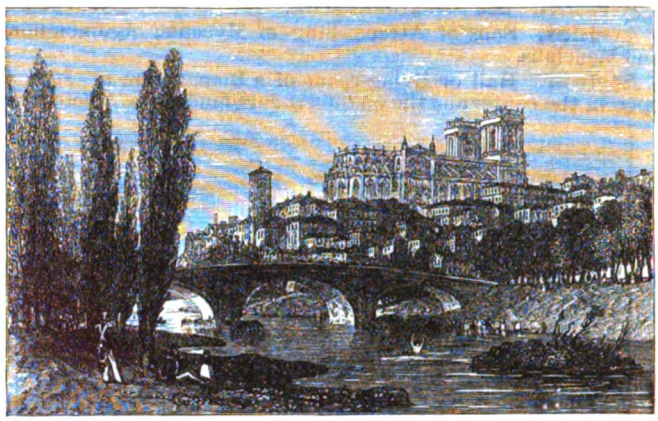
Auburn. City of Cayuga co., N. Y., at outlet of Owasco Lake; settled 1793. Its leading industry is the manufacture of agricultural tools and machines. Pop., 1890, 25,858.

Auburn Theological Seminary, N. Y. Founded 1818 by Geneva Presb. Synod at Auburn, N. Y. It has 7 professors, ab. 50 students, a library of 23,000 vols., and an endowment of $550,000.

Aubusson, PIERRE D', 1423–1503. French soldier, grand master of the order of St. John of Jerusalem 1476, cardinal 1489. In 1480 he withstood the siege of Rhodes by 100,000 Turks under Mohammed II.

Aucassin et Nicolette. Early French romance in prose and verse.

Auch. French city on R. Gers, known to Romans as Augusta Auscorum. Pop. ab. 15,000. The old city was across the river. The cathedral of St. Mary on the hill was commenced in 1489, and is one of the most ornate in France in all particulars.



Auch.

Auckland. City and seaport of n. New Zealand, on Thames Gulf. Pop., 1891, 28,773; suburbs, 22,514.

Auckland Islands. Group s. of New Zealand, belonging to Gt. Britain.

Auction. Public competitive sale, in which goods are bought by the highest price. A sale by public outcry at a fixed price is not an auction. Auctioneers are required in most jurisdictions to be licensed and to give bonds for the faithful performance of their duties. Each bid is an offer which may be withdrawn before the hammer falls. Puffing or fictitious bidding instigated by the seller and secret agreements to stifle competition are fraudulent practices which will avoid the sale. In the Netherlands the mode of sale is reversed, the auctioneer starting with a high price, which is lowered until a bidder is willing to pay the amount named.

Auction Pool. Selling chances in a pool by auction, either by number or for choice, the winning number receiving the whole pool.

Audiffret-Pasquier, EDME ARMAND GASTON, DUC D', b. 1823. French senator for life 1871, pres. Senate 1876, Academician 1878.

Audiometer. Apparatus auxiliary to the HUGHES INDUCTION BALANCE (q.v.). It consists of movable and adjustable coils of wire. The unbalanced induced currents in one of these coils, to which the telephone is attached, causes the sound.

Audiphone. Instrument contrived to facilitate hearing. It consists of a thin plate of vulcanite, which is kept curved by strings under a certain degree of tension. This device, with its edge placed in contact with the teeth, takes up waves of sound from the air and conveys them to the bones of the head, and thence to the auditory nerves.

Auditor. One who examines accounts and compares the charges with vouchers or other papers. The U. S. Treasury Dept. has six. The first audits the accounts of the civil service, public debt, and customs; the second, those relating to Indian affairs and a part of the army; the third, those of the quartermaster-general, engineer corps, and commissary-general; the fourth, of the navy; the fifth, those of the internal revenue, patent office, and state department; the sixth, the postal accounts. A private auditor examines the accounts of individuals. An auditor-general usually possesses greater powers, as his determinations are not subject to review.

Auditorium. Room in which persons assemble to listen. The body of a church is often so called, to distinguish it from its appendages.

Auditory Apparatus. Parts concerned in hearing, *i.e.*, the auditory nerve, middle ear, Eustachian tube, and external ear or auricle.

Auditory Organs. Organs of hearing; in lower animals usually closed, sac-like spaces, into which project sensory hairs connected with nerves, and acted on by the vibrating fluid (endolymph) in which is suspended one or more otoliths, which may be secreted by the animal, as in jelly-fishes, or be sand grains introduced from without, as in cray-fishes. In land animals the endolymph is set in motion by means of a tympanum. In *Amphibia* and *Sauropsida* a columella auris (stapes) is added, re-enforced by the auditory ossicles in mammals.

Auditory Ossicles. Chain of bones which unites the tympanum and fenestra ovale in mammals. From without in-

wards they are the malleus, incus, and stapes (hammer, anvil, and stirrup). They are derived respectively from the articulare, quadrate and hyo-mandibular (pharyngohyal).

Auditory Tentacles. See TENTACULOCYSTS.

Auditory Vesicles. Sac-like auditory organs of certain jelly-fishes, known as *Vesiculata*.

Audouin's Law. One part of the segments of an insect develops at expense of the others.

Audubon, JOHN JAMES, 1780–1851. American naturalist, celebrated for his sketches of birds, made during protracted forest excursions of great range. In 1826 he exhibited in Europe his second collection (the first had been eaten by rats) of paintings, and published 435 plates, with 1,055 life size figures. *Birds of America*, 4 vols., 1826–38; *American Quadrupeds*, 3 vols., 1845–48; *American Ornithological Biography*, 5 vols., 1831–39; *Biography of American Quadrupeds*, 3 vols., 1846–53.

Aue, HARTMANN VON, ab. 1170–ab. 1220. German epic poet. *Erec*, ab. 1195; *Iwein*, ab. 1202.

Auerbach, BERTHOLD, 1812–1882. German novelist of Jewish family. Tr. *Spinoza*, 5 vols., 1841; *Village Tales*, 1843–48; *On the Heights*, 1865; *Villa on the Rhine*, 1869; *Waldfried*, 1874.

Auersperg, ANTON ALEXANDER, COUNT VON ("ANASTASIUS GRUN"), 1806–1876. Austrian poet and liberal. *Walks of a Viennese Poet*, 1831.

Auerstadt. Saxon village, where the Prussians under the Duke of Brunswick were defeated by the French under Davoust, Oct. 14, 1806. See JENA.

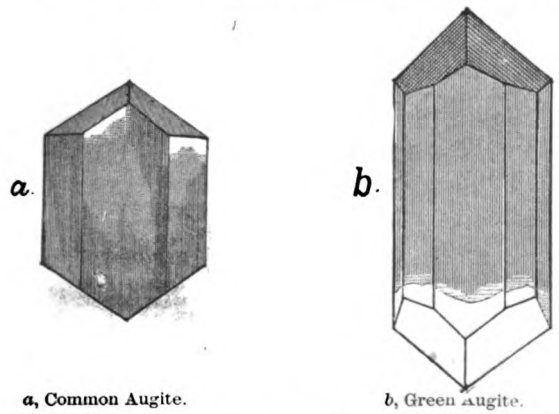
Augean Stables. Augeas, king of Elis, had 3,000 oxen whose stalls had not been cleansed for 30 years. Hercules accomplished the task in a day by turning the rivers Alpheus and Perseus through the stalls.

Auger, EDMOND, 1530–1591. French Jesuit, famous for eloquence. *Catechism*, 1568.

Augereau, PIERRE FRANÇOIS CHARLES, DUC DE CASTIGLIONE, 1757–1816. French marshal 1806. As general of division, 1796, he helped to win the victories of Lodi, Castiglione, and Arcola. He gained further honor at Jena 1806, and Leipzig 1813.

Augier, GUILLAUME VICTOR ÉMILE, 1820–1889. French dramatist; Academician 1857. He excelled as a wit and satirist. Perhaps his most noted plays are *The Adventuress* and *Gabrielle*, 1848–49.

Augite. Variety of pyroxene, common as an ingredient of crystalline rocks. It consists of silicates of lime and magnesia, the latter being sometimes replaced by ferrous oxide. It crystallizes in 6 or 8-sided prisms.



a, Common Augite. *b*, Green Augite.

Augmentation. In Botany, increase in numbers in the parts of any of the circles of organs which form the flower; also known as multiplication.

Augsburg. City of Bavaria, on the Wertach and Lech rivers; founded by Augustus 12 B.C. It rose to great prosperity by commerce; was a free imperial city 1276–1806, and was long the emporium of trade between n. and s. Europe; eminent also in manufactures and art. Here the Bavarians were defeated 954 by troops of Otto I., and an immense army of Huns, Aug. 10, 955. Many diets of the Empire were held here. The league of A. was concluded July 9, 1686, between various German powers, Spain, Sweden, and the United Provinces against France. Pop., 1890, 75,223.

Augsburg Confession. Chief exposition of Lutheran doctrine; written by Melancthon and presented to Charles V. at Diet of Augsburg, 1530. By the treaty of Augsburg, Sept. 25, 1555, its adherents were declared free from Catholic interference.

Augurs. Roman college of 3 or 4, then 9, later 15, diviners, who from the flight of birds or other omens ascertained the will of the gods and foretold future events; they held office for life and were of much importance in the state.

August, ERNST FERDINAND, 1795–1870. Director of gymnasium in Berlin. Author of *Psychometric Formulæ* and tables much used in Germany, and of treatise on hygrometry.

Augusta. Capital of Maine; on both banks of Kennebec R. at head of navigation. Pop., 1890, 10,527.

Augusta. City of Richmond co., Ga., on right bank of Savannah R., at head of steamboat navigation. It has excellent water-power and large manufactures of cotton goods. Pop., 1890, 33,300.

Augustana College. Founded at Chicago 1860 by Augustana Lutheran Synod; removed to Paxton, Ill., 1863, and to Rock Island 1875. It has 19 professors, 360 students, and a Theol. Dept.

Augustan Age. Epoch of Roman history when Augustus ruled, 31 B.C. to A. D. 14. The names of Virgil, Horace, Ovid, and Livy make the period the most illustrious of the Empire. It was said that Augustus found the city brick and left it marble.

Augustan History. Biographies of the Roman emperors 117–284, all before Hadrian having perished. Spartianus, who is thought identical with Lampridius, wrote the lives down to Alexander Severus; Capitolinus, from Maximin to Gordian III.; Trebellius Pollio, as far as Claudius Gothicus; and Flavius Vopiscus the rest. They have historical value, but little literary merit.

Augusti, JOHANN CHRISTIAN WILHELM, 1772–1841. German theologian, prof. at Jena 1803, Breslau 1812, and Bonn 1819–33. *Christian Archæology*, 1817–31, 12 vols.

Augustine, or AUSTIN, d. 607. "Apostle of England," sent by Pope Gregory I. to convert the Angle-Saxons 596; first abp. of Canterbury 598. The Church was already there, with its bishops and priests, but the land was largely pagan, and Austin's efforts were efficacious, especially in Kent.

Augustine (AURELIUS), ST., 353–430. Bishop of Hippo, Africa, 396; greatest of the Latin Fathers. In youth a Manichæan and a profligate, he was baptized by St. Ambrose 387, and soon became the master-mind of the Church, exerting an influence still felt. His treatises on *Predestination* and *Perseverance* anticipate Calvin's whole system. His *Confessions*, ab. 397, is a classic. His greatest work is *De Civitate Dei*, ab. 426.

Augustine, SISTER. AMALIE VON LASAULX. 1815–1872. German Sister of Charity, who adhered to Old Catholicism in 1871, and was deposed.

Augustinians. One of the four Mendicant Orders (the others being Dominicans, Franciscans, and Servites, organized 1243 by Innocent IV.

August-psychrometer. Pair of thermometers, dry-bulb and wet-bulb respectively, as arranged by E. F. August, for determining the moisture of the air.

Augustulus, ROMULUS. Last emperor of Rome, 475–6.

Augustus, 63 B.C.–A.D. 14. First Roman emperor. His name, C. Octavius, was changed at his adoption by his great-uncle, 47, to C. Julius Cæsar Octavianus. He fought Antony and defeated him, was elected Consul 43, was reconciled to Antony, and with him and Lepidus formed a 5-years' triumvirate; with the help of Antony crushed the republican party at Philippi 42; conquered Sextus Pompey and Lepidus 36, and Antony and Cleopatra at Actium 31, and thenceforth ruled the Roman world under constitutional titles, being styled Augustus by the Senate 27 B.C. His wars were waged mainly to protect frontiers. Other intended successors having died, he adopted Tiberius, son of his second wife Livia, as colleague and heir. His name, being properly an official title, belonged to all his successors.

Augustus.

Augustus. Three electors of Saxony. I., 1526–1586, ruled from 1553. II., FREDERIC A., "the Strong," 1670–1733; succeeding his brother George 1694, he fought the Turks in Hun-

gary, purchased election to the Polish throne 1697, was defeated in war with Sweden and forced to abdicate 1706, regained the throne 1709, and kept it by alliance with Russia. III., His son and namesake, 1696–1763, succeeded him as elector and king, was twice defeated in war with Prussia, and twice fled from Dresden.

Auks. See ALCIDÆ.

Aulic Council. Created 1495 to deal with matters affecting the German emperor, and continued in Austria after 1806.

Aulophyte. Plant which lives within another plant but does not draw nutriment from it.

Aumale, CHARLES DE LORRAINE, DUC D', 1556–1631. One of the Guises; leader, with Mayenne, of the Catholic League; repeatedly defeated by Henri IV.; condemned 1595, and lived in exile.

Aumale, HENRI EUGENE PHILIPPE LOUIS D' ORLEANS, DUC D', b. 1822. Fourth son of Louis Philippe; in England 1848–71; member of the Assembly and Academy 1871; exiled 1886–89. His historic castle of Chantilly was presented to the Institute 1886.

Aunt Sally. English game, played at fairs and race-courses. A wooden head with a pipe in its mouth is set up to be thrown at, the players endeavoring to smash the pipe by throwing balls or clubs at it. A great variety of heads are used, often representing public characters.

Auramine. $C_{17}H_{24}N_3ClO$. Hydrochloride of amidotetramethyldiamidodiphenylmethane; prepared by heating tetramethyldiamidobenzophenone with sal ammoniac and zinc chloride; important yellow dye-stuff, used in coloring cotton.

Aurantia. $C_{12}H_8N_8O_{12}$. Imperial Yellow; ammonium salt of hexanitrodiphenylamine, made by the action of nitric acid upon diphenylamine; yellow coloring matter.

Aurelia. See SEMÆOSTOMEÆ.

Aurelianus, LUCIUS DOMITIUS, 214–275. Roman emperor 270; victorious over Goths, Vandals and Germans 270; over Zenobia, queen of Palmyra, 273; also in Gaul, Spain and Britain 274; slain by his secretary. He was a great soldier, and the "restorer of the empire," carrying toward completion the work of his predecessor Claudius II.

Aurelius Antoninus, MARCUS, 121–180. Roman emperor and stoic philosopher. In a corrupt age he led a life of singular purity and virtue. During his reign, 161–180, which was marked by many public calamities, he was engaged in continual warfare, and proved an able general. He considered himself "steward of God and servant of the people." His *Meditations*, full of memorable passages and closely approaching the N. T. morality, are an admirable summary of the noble, practical philosophy which guided his life. They have been repeatedly tr. into English, last by Geo. Long, 1862.

Statue of Emperor Marcus Aurelius.

Aurelle de Paladines, CLAUDE MICHEL LOUIS D', 1804–1877. French general, prominent in the Crimean and Franco-German wars.

Aureosine. Product of the action of hypochlorous acid upon FLUORESCEIN (q.v.).

Aureus. Roman gold coin, issued from 207 B.C. on. Its average weight was 120 grains, a little over $5.

Auric Acid. $Au(OH)_3$. Yellowish-red powder, insoluble in water and the acids; made by treating auric chloride with magnesia and dilute nitric acid.

Auric and **Aurous Compounds.** See GOLD, COMPOUNDS OF.

Auricle of the Ear. Outer ear, or fleshy and cartilaginous projection from the side of the head, which originally in man and now in most animals serves to collect and transmit sound-vibrations to the inner ear.

Auricles of the Heart. Smallest two of the cavities of the heart, which on the right side receives the venous blood from the body, and on the left that purified and oxygenated by the lungs. See HEART.

Auricula. Bony arch near the mouth of a Sea Urchin, inside its shell, which covers the radial water tubes. It is the homologue of the ambulacral ossicles of star-fishes.

Auricular Confession. R. C. and Oriental usage of confessing at least all mortal sins into the ear of a priest as part of the sacrament of penance. Authorized by Leo ab. 450, it was made obligatory by the 4th Lateran Council, 1215, and declared by the Council of Trent (1545–63) indispensable to salvation.

Auricularia. Pluteus-like larva of Holothurians. It has short arms and assumes a pupa stage with five circles of cilia. The entire body is transformed into the adult.

Auriculidæ. Family of Pulmonates, of the sub-group *Basommatophora*.

Aurifaber (GOLDSCHMIDT), JOHANN, 1519–1575. Luther's secretary 1545–46, and editor of his German books and letters.

Auriga. Northern constellation, containing the large star Capella; also called the Wagoner.

Aurine. $C_{19}H_{14}O_3$. Impure trioxytriphenylcarbinol, prepared by the action of oxalic and sulphuric acids upon phenol; commercially used for rosolic acid; red dye-stuff, formerly used in wool-dyeing.

Aurispa, GIOVANNI, 1370–1459. Teacher in Italy, who in 1423 brought from Constantinople the writings of Plato, Pindar, Æschylus, and other Greek classics, then unknown in the West.

Aurochs (*Bison bonasus*). Nearly extinct Bison of Europe, preserved only in the forests of Lithuania.

Aurora. Goddess of the dawn, daughter of Hyperion. At the close of the night, leaving the couch of Tithonus, she ascends in a chariot from the river Oceanus, to herald the coming of the sun.

Aurora. (1) Bright light of the early morning before sunrise. (2) Diffuse light seen at night, usually near the n. portions of the heavens in the northern hemisphere and the s. in the southern. It frequently exhibits red, yellow or green colors, arranged in arched columns and beams and folded curtains. When brightest, the beams and rays are usually longer and broader.

Periodic waves in brightness run rapidly along each beam, or converge from all directions toward the auroral corona; when only a simple beam crosses the sky, such waves appear in it as individual auroral clouds with a rapid progressive motion. Sometimes several concentric arches separated by diffuse light are seen; below the lowest arch is a dark space.

The Auroral Corona is an arrangement of small auroral beams around a central point, usually near the direction of the freely suspended magnetic needle; within the corona thus

Aurora Borealis.

formed only a faint diffuse light prevails. Displays of the aurora are most frequent at 9 or 10 P.M., in special months depending upon geographical locations, and in years of greater sun-spot frequency.

Aurora. City of Kane co., Ill., on Fox River. The Chicago, Burlington and Quincy R. R. has its shops here. Pop., 1890, 19,688.

Aurungzebe, 1618–1707. Mogul emperor of Hindostan, third son of Shah Jehan. Overcoming his eldest brother, Dara, who had seized the throne upon his father's illness, he began to reign 1658; imprisoned his father till his death 1666; had his two elder brothers assassinated; made some additions to the empire, and had a long and brilliant reign, though his bigotry and intolerance alienated the Hindoos.

Auscultation. Act of listening to the sounds produced within the body as a means of determining the absence or

presence of disease. It is called immediate when the ear is applied directly to the body, and mediate when some object, as a stethoscope, is interposed. Is employed chiefly in diseases of the heart, lungs, and pleura, and in pregnancy after the beats of the fœtal heart are sufficiently strong to be heard.

Ausonius, DECIMUS MAGNUS, ab. 310–ab.394. Latin author, b. at Bordeaux. He held many civil offices, taught rhetoric, and wrote letters, epigrams and poems which survive. His style was harsh, but not without merit.

Auspices. With the Romans, observing of birds, by means of which the will of the gods, or future events, were supposed to be ascertained. The chief magistrates, or the commander of an army, had the right of taking them.

Austen, JANE, 1775–1817. English novelist, noted for acute observations of character and society. Her books, *Sense and Sensibility*, 1811; *Pride and Prejudice*, 1813; *Mansfield Park*, 1814; *Emma*, 1816; *Northanger Abbey*, 1818; and *Persuasion*, 1818, are still highly valued.

Austerlitz. Town in Moravia, scene of a victory gained by 80,000 French under Bonaparte over as many Austrians and Russians Dec. 2, 1805. The French lost 12,000, the allies 30,000. A treaty of peace was signed at Presburg Dec. 25.

Austin. Capital of Texas, in Travis co., on left bank of Colorado R.; founded 1821. Pop. ab. 20,000.

Austin, ALFRED, b. 1835. English poet, author of many lyrics and several tragedies.

Austin, COE FINCH, 1831–1880. American botanist, author of numerous papers on Hepaticology.

Austin, MRS. JANE GOODWIN, 1831–1894. American novelist. *A Nameless Nobleman*, 1881; *Standish*, 1889; *Dr. Le Baron*, 1890; *Betty Alden*, 1891. These deal with colonial history.

Austin, JOHN. d. 1669. English R. C. author. His *Devotions*, 1668, include some fine hymns.

Austin, JOHN. 1790–1859. Prof. Univ. London 1826–32. *Province of Jurisprudence*, 1832; *Sequel*, 1861–63.—His wife, SARAH (TAYLOR), 1793–1867, wrote on education, and tr. Ranke's *Hist. Popes*, 1840, and other German and French books.

Austin, STEPHEN F., ab. 1790–1836. Pioneer in Texas, founder of Austin, and in command of the Texan army 1835.

Australasia. One of the six great geographic divisions of the globe, comprising Australia, New Guinea, Tasmania, New Zealand and numerous other islands of the Pacific.

Australia. Largest island or smallest continent on the globe, between s. Pacific and Indian Oceans; length from e. to w. ab. 2,500 miles, breadth ab. 2,000; area ab. 2,947,117 sq. m. Its surface is that of a low plateau, elevated but a few hundred feet above the sea. It is level or rolling, and broken here and there by ranges of hills. On the e. and w. the borders of the plateau are outlined by mountain ranges. Its average elevation is ab. 800 feet. The highest summit of the Australian Alps, in the s. e., is Mt. Kosciusko, 7,176 ft. On the e. coast the rainfall is sufficient for agriculture, but in the interior it is much less, and a large part is a desert, as yet imperfectly explored. It has few rivers of importance. The inhabited parts are mainly on and near the s. and e. coasts. A. was visited or mentioned by the French, Dutch, and Spaniards 1542–1616, seen by Dampier 1688, and for a time called New Holland. Capt. Cook explored the e. coast 1770. The penal settlement of Botany Bay was made 1787–88 in New South Wales. Of the other colonies, Western A. was set off 1829, South A. 1834, Victoria (s.e.) 1859, and Queensland (n.e.) 1859. Each of these has its parliament, with a governor appointed by the queen; a scheme of confederation is in progress. Gold was discovered Feb. 1851, 20 m. n. of Bathurst, New S. Wales, and soon after at Ballarat, 80 m. w. of Melbourne, causing a vast influx of miners and adventurers from Europe, America, and China. Of late years labor troubles have been rife. Pop., 1891, 3,173,000, chiefly in Victoria and New S. Wales; Western A., with over a third of the territory, had but 46,290. Ab. 30,000 natives remain.

Australian Aborigines. Once estimated at 150,000, but now much reduced. They are considered the lowest of the human race. The cephalic index is 71, the average capacity of the cranium (97.6 in Europeans) is 76, but the smallest skull had a capacity of 63 cubic in. There seems to be a dwarf type averaging 5 ft. high and a type 7 inches taller, of which a woman was found 7 ft. in ht. The West Australians are the lowest. The limbs are long and slender, the belly protuberant, the skull thick-boned, prognathous, with narrow forehead and retreating, small chin. The superciliary ridges are prominent, the hair abundant, soft, and curling. The lips are large, the toes turn in. They hate to work, but are good hunters, gentle in disposition, but irascible when irritated. Their memories are strong and they learn quickly, but cannot master principles; they have no words for numerals above four or five. The mode of life is communistic. They are generous, always sharing what is gotten, taking no thought of the future. They mature at ten or twelve; have no sense of modesty; the men are more dressed (chiefly ornaments) than women. Wives are either bought or captured, always from a different family and caste, and the children belong to the caste of the mother. The heads of children are often artificially deformed. Tattooing is practiced, also painting; white is the color for mourning. They are nomadic, build only rude bark huts, and eat anything, including reptiles and worms. They cultivate nothing, but cook everything except human flesh, which is eaten raw. They make no pottery, but are skillful in making simple weapons; the tomahawk, club, spear, boomerang, and shield are remarkable. The boomerang does not return to the thrower if it hits anything; it is used mainly in killing birds. Rude canoes and rafts are made. Polygamy is practiced. There is no marriage ceremony, except that the wife has her left little finger cut off as a sign of servitude. The boys pass through three degrees of initiation into the tribe, accompanied by elaborate ceremonies and torture; these degrees are taken at 9, 16, and 20 years. The men love to dance, sing, and feast, often ending with a free-fight and the eating of the slain. Chiefs are temporary leaders. They have no written language nor worship. The dead are either buried, burned, or exposed.

Australian Province. Zoölogical region including Australia, New Guinea, New Zealand, and usually also Polynesia. Characteristic animals are the Echidna, Ornithorhynchus, Marsupials, Mud-fish (*Ceratodus*), Cockatoos, and Birds of Paradise. There is an absence of Placental Mammals. New Zealand moreover lacks Marsupials, Monotremes, and Reptiles, except lizards, and possessed the now extinct *Dinornis* and *Apteryx*.

Austrasia, or EAST KINGDOM. Under the Merovingians, embracing Lorraine, Belgium, and right bank of the Rhine; after Charlemagne, it was merged into Germany.

Austria, HISTORY OF. In 796 the territory between the Ens and Raab was made a margraviate; in 12th cent. it was joined to the Mark above the Ens, and made a duchy. It became the possession of the House of Hapsburg 1282, and rapidly increased in power and extent of territory. Albert V., 1404–1439, obtained Bohemia and Hungary, and was elected to the imperial throne, which from 1438 was held by this house. A. was made an archduchy by Frederic III.; the Netherlands were acquired by Maximilian I., whose son Philip married Johanna of Spain. His son Charles V. was elected emperor 1519, and abdicated in favor of his brother Ferdinand 1558. On his death, the inheritance was divided among his three sons, Maximilian II. receiving the imperial crown, with A., Hungary, and Bohemia. All these his son, Rudolf II., was forced to cede to his brother Matthias, who became emperor 1612, and concluded the long wars with the Turks by a 20 years' truce.

Matthias ceded Bohemia and Hungary to his cousin Ferdinand, afterward emperor, who undertook to root out Protestantism from his dominions, thus beginning the Thirty Years' War. Under Leopold I. Vienna was rescued by John Sobieski from the Turks called in by Hungary. Hungary was reduced and declared a hereditary kingdom. The War of Spanish Succession, 1702–13, ended with the peace of Utrecht, which secured to A. part of the Netherlands and possessions in Italy; some of these were soon lost. With Charles VI. (d. 1740) the male line of the Hapsburgs expired. The succession of Maria Theresa was maintained by the aid of Hungary. She was forced to yield Silesia to Frederic the Great after a vain effort to recover it by the Seven Years' War. Her husband was elected emperor as Francis I. 1745. Her son, Joseph II., made unsuccessful efforts at reform in his dominions. War with France followed the French Revolution 1792; by the treaty of Campo Formio, 1797, A. lost Lombardy and the Netherlands, receiving Venice; war renewed 1799, ending in the peace of Luneville 1801. Francis II. declared himself hereditary emperor of A. 1804, and abdicated the imperial throne of Germany 1806. The alliance with Napoleon by his marriage with Maria Louisa, daughter of Francis, did not hinder Francis from aiding in his downfall. A. gained territory by the peace of Vienna. Her influence was henceforth commanding in Europe, and adverse to constitutionalism. Opposition to her rule was brought to a crisis by the events of 1848, which resulted in war with Hungary, and ended with the triumph of conservatism, though feudalism disappeared. In 1850 A. was excluded from the German confederation. Her rivalry with Prussia was ended by the war of 1866, which caused the loss of Venetia. In 1867 a constitution was adopted, and the emperor proclaimed King of Hungary. In 1878 Bosnia and Herzogovina were added to this vast and mongrel empire, a congeries of countries, races, and religions, of which two of the largest and most populous provinces, Galicia and Bohemia, have not equal or adequate rights.

Austria-Hungary. Area 241,136 sq. m. The s. w. portion is very mountainous, being occupied by the e. part of the Alps. The Carpathian Mts. form parts of the e. and s.

boundaries, rising to heights of 8,000 to 9,000 ft., and inclosing the plains of Hungary in their great curve. The remainder of the country presents no marked features of relief. Nearly all of it is drained by the Danube, which is navigable throughout its course here, as are several of its branches for hundreds of miles each. Ab. 400,000,000 bushels of cereals are annually produced, and ab. 375,000,000 gallons of wine. Its mineral resources are valuable, comprising gold, silver, iron, copper, lead, and tin. Coal is mined extensively. The entire mineral product has an annual value of ab. $55,000,000. The manufacturing industries are large and varied, including mainly cotton, linen, woolen, and silk goods, and iron and steel, with an annual product estimated at $650,000,000. External commerce is not great, owing to the small extent of seacoast. The extent of railroads in operation is ab. 15,000 m. Austria and Hungary are closely allied in their internal affairs; each has its own council and parliament, while the army and navy are common, and in foreign affairs the two governments are a unit. The capital of Austria is Vienna, of Hungary Buda-Pesth. Other important cities are Prague, Lemberg, Gratz, Brunn, and Trieste. Pop., 1890, 41,284,960.

Austro-Columbian Region. All America s. of Mexico.

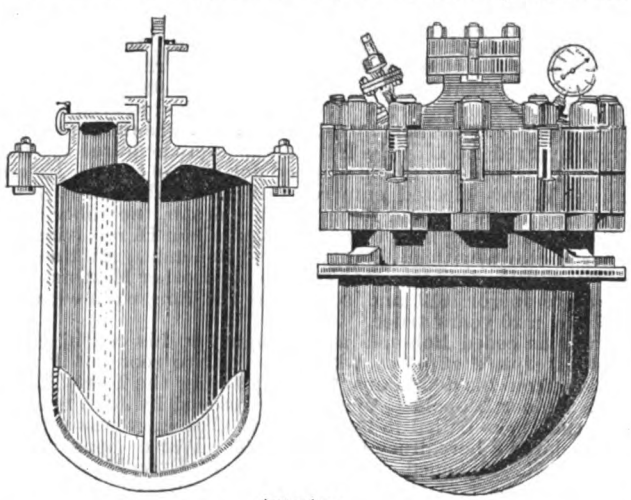
Austrogæa. Australasian province plus the Austromalayan Archipelago.

Austromalaya. Papua and adjacent islands n. of Australia.

Autarachna. Division of *Arachnida*, including *Acarina*, *Araneina*, and *Arthrogastra*.

Authors. Game of cards printed with names of writers and titles of their works; invented in Salem, Mass., and pub. 1861. Numerous variations exist. The method of play was copied from the older game of DR. BUZBY (q.v.).

Autoclave. Apparatus designed to heat liquids at temperatures above their boiling-points. Largely used in the manufacture of coal-tar colors. It is heated in oil or lead bath.



Autoclave

Autocracy. Government in which the law-making and executive powers are united in one person; despotism.

Auto da Fé. Execution by fire of those condemned by the inquisition in Spain and Portugal, 1481–1761.

Autœcious. In mycology, parasitic *Fungi* which carry out their entire life-history on a single plant; also, in bryology, mosses where the antheridia and archegonia are borne upon the same plant.

Autogamy. Self-fertilization of flowers, the pollen acting on the pistil of the same flower in which they are both borne; known also as close-fertilization.

Autogonia (AUTOGENESIS). Spontaneous generation of living organisms from inorganic (or at least, unorganized) matter.

Autograph. Handwriting of a person in distinction from the work of an amanuensis. The collection of these has become a popular pursuit, and large prices are paid for those of distinguished persons. This has led to the imposition of imitations and necessitates care in their selection. Reproductions by photographic and etching processes have been published. The handwriting indicates habit rather than character.

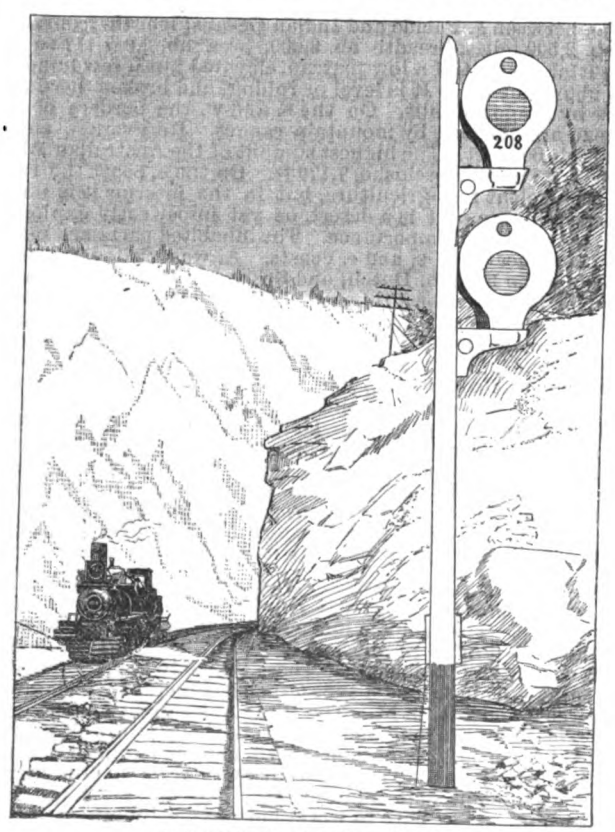
Autolycus, ab. 330 B.C. Greek mathematician, who wrote *On the Moving Sphere*, and *On the Risings and Settings of the Stars*.

Automatic Action. Action of a living body not immediately due to external changes of environment, but the result of changes arising in the organ or body itself, and determined by causes other than the circumstances of the moment. These actions may be continuous or rhythmical, as beating of heart; or irregular and variable, as all actions resultant on volition.

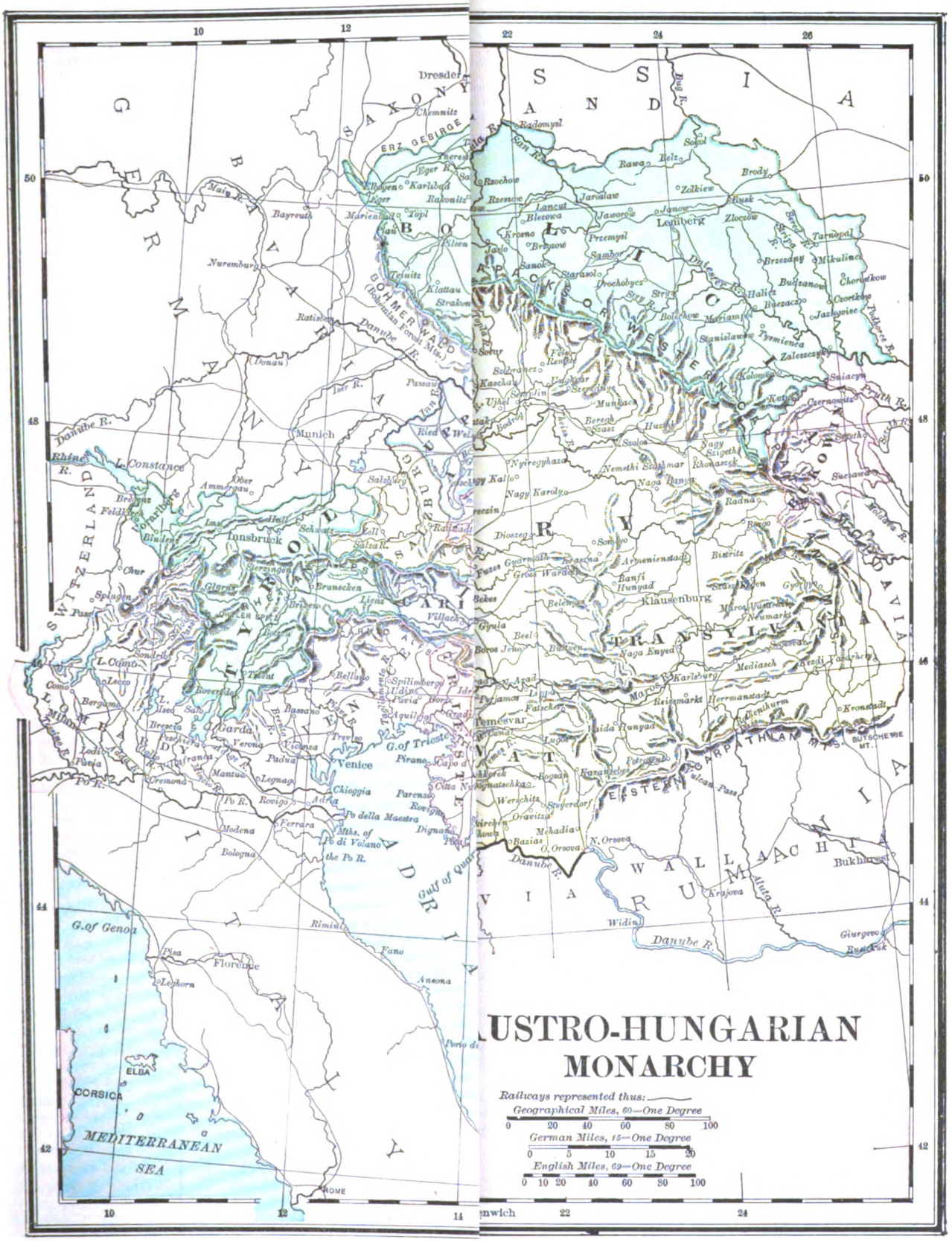
Automatic Cut-Off Engine. One in which the valve gear which distributes the motor fluid from the generator to the cylinder is so constructed that without human intervention the engine itself will alter the point at which the supply of fluid shall be cut off from the cylinder. The object is to cause the engine under wide variations of load to make the same number of revolutions in a given time. In attaining this, it is sought to supply to the cylinder at each stroke only so much fluid as is necessary to overcome the load at the specified speed. Automatism is secured in two general ways: the cut-off is varied directly, by the load, or indirectly, by the speed as affected by the load. In the first system, the effort on the engine shaft is transmitted to the load through a series of springs of requisite strength and stiffness on that shaft. The springs are therefore more or less strained as the load increases or diminishes. The positions of levers attached to these springs are made to adjust the point of cut-off in some of the methods alluded to in article ADJUSTABLE CUT-OFF (q.v.).

In the second system, a governor driven by the engine shaft is so arranged that the plane or position of a revolving mass shall be varied by variations in the speed of the engine. This revolving mass is so linked to the distributing gear that the valve shall remain open for admission of steam a shorter or longer fraction of the piston stroke, as the speed of the governor is faster or slower. This latter is the most usual system, but has the theoretical disadvantage that the variation of load must precede the variation in speed, which must occur before the variation in cut-off can occur which is to offset the first variation and keep the speed constant. The cut-off must therefore always be hunting the load, and cannot get nearer to it than a certain number of revolutions. But, practically, by running at a high number of revolutions per minute and with a sensitive governor the time becomes very small during which such irregularity may exist, and the percentage of irregularity correspondingly low.

Automatic Signals. Signals, usually indicating danger, which are displayed on railroads without direct manipulation, being operated by rods and levers which are connected with the track; *e.g.*, the opening of a switch may be made to set a signal in the danger position at a point several hundred feet



Automatic Electric Block Signals.


AUSTRO-HUNGARIAN
MONARCHY
Railways represented thus:
Geographical Miles, 60—One Degree
0 20 40 60 80 100
German Miles, 15—One Degree
0 5 10 15 20
English Miles, 69—One Degree
0 10 20 40 60 80 100
Dresden
Munich
Innsbruck
Venice
Florence
Rome
Lemberg
Klausenburg
Temesvar
Bukharest
Krajova
Danube R.
Rhine R.
Po R.
L. Constance
L. Como
L. Garda
G. of Genoa
G. of Trieste
Gulf of Quarnero
MEDITERRANEAN SEA
CORSICA
ELBA
SWITZERLAND
GERMANY
BAVARIA
SAXONY
BOHEMIA
GALICIA
TYROL
TRANSYLVANIA
WALLACHIA
RUMANIA
ITALY
ADRIATIC
EASTERN CARPATHIAN MTS.
BUTSCHEWE MT.
Greenwich

away, and the closing of the switch lowers it again. Drawbridges are usually protected by such signals. Electricity is used in some cases to set the levers in motion, particularly in the block-system of operating trains.

Automatons. Beings supposed to be without freedom, all their actions being spontaneous and without conscious purpose.—Mechanical toys imitating men or animals have been made from the earliest times. Vaucanson's flute-player 1738, flageolet-player 1741, and duck, very lifelike, even digesting food, are well authenticated. Maelzel exhibited a trumpeter 1809, also a rope-dancer and a chess-player. Song-birds and other toys of quite perfect construction are now produced.

Autonomy. Right of independent action; self-government, as in the towns of Ancient Greece.—In philosophy, capacity of free moral choice and volition.

Autoplast. Cell arising spontaneously in the yolk of a segmenting egg. See CHLOROPLASTID.

Autoplasty. Substituting healthy for diseased tissue from same body, as making a nose from the skin of the forehead.

Autopsy. Examination of human bodies for the determination of the reasons for death either in cases due to natural causes, accidental or intentional violence, or poisoning; believed to have been first performed ab. 300 B.C. in the Alexandrian school of medicine. To be of value it must be made shortly after death and prior to the use of embalming fluids, which may alter the appearances of the tissues and often contain substances which are poisonous in themselves or may render difficult the detection of poisons entering the body before death.

Autotemnous. Capable of reproduction by fission, as are *Protozoa* and ordinary tissue cells.

Autotype. Picture produced by means of a photographic negative, acting upon a carbon film. The film is made by coating paper with a mixture of gelatin, sugar, and coloring matter, which is rendered sensitive to the action of light by bichromate of potash or ammonia. The bichromated gelatin is rendered insoluble proportionately to the light transmitted by the negative. After exposure the film is placed on an india-rubber slab, and made to adhere to it by means of a "squeegee." When the contact is perfect, the whole is immersed in hot water, which soon softens the paper to a degree that it can be peeled off, leaving behind it the gelatin film. This is allowed to remain in tepid water until the soluble portion, unacted upon by light, is dissolved and washed away. After thoroughly dry, the film is transferred to a waxed or gelatinous paper, to which it fastens itself, and the tones of the print are produced by the varying thickness of the remaining film. As the pigments used as coloring matter are as permanent as ink, they have all the lasting qualities of type-printed impressions from ink on paper. As any coloring matter can be added to the composition, from the deepest blacks to the highest blues, this process is very valuable in the reproduction of old drawings, and other works of art in wash or colored chalks.

Of late years a process invented by Johnson, which has a heavily sized paper for the developing base, making it a flexible support, has added materially to the average result. All the well-known Braun prints are produced by this method.

Autozoöids. True or complete polyps of a differentiated (dimorphic) Alcyonarian colony.

Autumn. Season of harvest, lasting from the Autumnal Equinox to the Winter Solstice.

Auvergne. Ancient French province, in a mountainous region, long defended by Arverni against Romans.

Auxanometer. Instrument or piece of apparatus for registering the rapidity of plant-growth.

Auxiliary Capital. Raw material, factories, and similar means of production, as distinguished from capital which maintains the life and efficiency of industrial workers.

Auxospore. Body produced by the conjugation of two diatom frustules, the protoplasmic contents uniting to form a body which is at first gelatinous throughout, but ultimately becomes covered by a cell-wall.

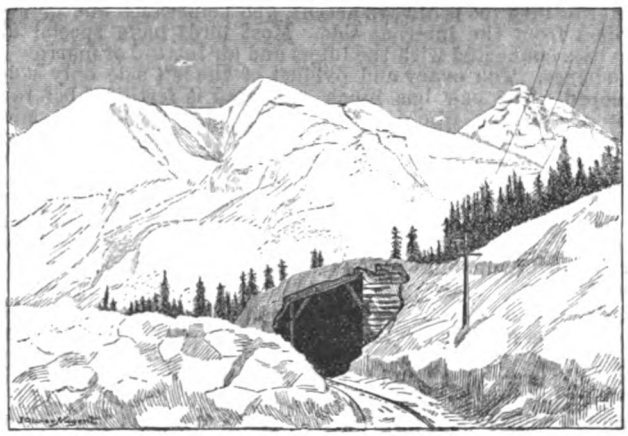
Auxotonic. Movements of growing vegetable organs.

Auzout, ADRIEN, 1630–1691. French mathematician and astronomer; one of the first members of the Academy, 1666. *Micrometer*, 1667.

Ava. *Macropiper Methysticum.* Plant of natural order *Piperaceæ*, native of South Sea Islands, from the root of which the natives prepare a fermented liquor having an effect like opium.

Ava. City on Irawaddy River, Burmah, formerly the capital; nearly destroyed by earthquake 1839. Pop. ab. 7,500.

Avalanche. Snow-slide. The expense of protecting railways in mountainous countries from these is often great, sheds being required to cover the track and deflect the avalanche.



Entrance to Snow-shed; Canadian Pacific Ry.

The Canadian Pacific Railway has expended over $3,000,000 for this item.

Avalon. Fabulous island where King Arthur was buried.

Avaricum. Ancient fortified town in Gaul, taken by Cæsar; now Bourges.

Avars. Asiatic tribe who troubled the Eastern Empire from ab. 555 till subdued by Charlemagne 769; probably akin to the Huns.

Avebury, or ABURY. Village in Wiltshire, Eng., having the largest prehistoric megalithic structure in Britain.

Avellaneda, GERTRUDE GOMES D', b. in Cuba 1816. Spanish poet, dramatist, and novelist; wife of Don Pedro Sabator, 1846.

Ave Maria. Prayer in R. C. Ch. called the Angelic Salutation; used to invoke the Virgin's aid.

Ave Maris Stella. A hymn of the R. C. Ch. in praise of the Virgin, supposed to have been written in the 7th or 8th century.

Avens. Species of the genus *Geum*, insignificant herbs of the Rose family.

Aventine Hill. One of the seven hills of Rome, on its extreme s. border, between the Palatine and the Porta San Paolo.

Aventinus, or **Thurmayer,** JOHANNES, 1466–1534. Historian of Bavaria. His work appeared 1534 in an expurgated form, and complete 1580.

Aventurine. Quartz or feldspar in which small scales or spangles of other minerals are disseminated.

Aventurine Glass. Brown, containing particles of metallic copper, called gold stone; used in jewelry.

Average. In law, injury not amounting to a total loss. Particular average is the damage falling directly upon an article. General average is the contribution by all the parties to an adventure toward an extraordinary loss sustained by some for the common benefit.

Avernus. Lake near Cumæ, Italy, in the crater of an extinct volcano, from which arose mephitic vapors, said to kill birds which came near; supposed to be connected with the lower world.

Averrhoes, 1126–1198. Arabian philosopher, b. at Cordova. He wrote works on medicine, law, and astronomy, but is best known as a commentator on Aristotle. In this capacity he exerted great influence on the development of scholastic philosophy. It is said that 100 editions of his works were printed in the century following 1472.

Averysboro. Village in N.C., scene of a battle between Sherman's and Johnston's forces, March 16, 1865.

Aves. Class of Vertebrates, including animals that are warm-blooded, oviparous, and feathered; with four chambers to the heart, the systemic and pulmonary circulations being completely separated. The right aortic arch persists. There is one occipital condyle. The jaw has no teeth in living birds, but bears horny sheaths constituting a beak. The neck is long, having 9 to 23 vertebræ that bear short ribs which unite with the transverse processes. The dorsal vertebræ are few; the sternum or breast-bone is well developed. The pelvis consists of two sacral vertebræ and many præsacral (lumbar) vertebræ, some of which bear ribs, united with the elongated ilium. The pubic and ischial bones extend backward, and usually form no symphysis. The anterior limbs are wings in which

the manus develops only the thumb (alula) and first two fingers. The legs have the knee concealed and a prominent intertarsal joint between the tibiotarsus and the tarso-metatarsus. The outer or fifth toe is always absent, and sometimes one or two others from the internal side. Most birds have special air cavities connected with the lungs and air instead of marrow in the bones. The ovary and oviduct of the left side only is developed. The egg has much yolk and is fertilized before it enters the duct where the white and shell are added. Most are monogamous, but migratory in flocks. The class contains four sub-classes, *Carinatæ*, *Ratitæ*, *Saurornithes*, and *Odontornithes*. This classification is likely to give way before the following: *Saururæ*, *Odontormæ*, *Odontolcæ*, and *Eurhipiduræ*; the last with the superorders: *Dromæognathæ*, *Impennes*, and *Euornithes*. See these terms. About 10,000 species of birds are known, which have been referred to 2,000 or 3,000 different genera.

Avesta, or ZEND-AVESTA. Collection of the sacred books of the Parsees containing the religion of Zoroaster. In its present form it does not go back of the Sassanian kings of Persia, under whom it was revised, but it may antedate Cyrus, 558–529 B.C. The books now existing are said to be only fragments of the original collection in Old Persian. They are four: the *Yasna*, consisting of hymns and other liturgical sections; this is the most ancient part, and contains portions attributed to Zoroaster; the *Visparad*, likewise liturgical; the *Vendidad*, which explains the dualistic doctrines and the priestly rules; and the *Khordah Avesta*, which, unlike the other three, was designed for the laity as well as the priests, being a species of book of devotion. Alexander the Great is said to have burned the complete collection in 21 books from which these were taken.

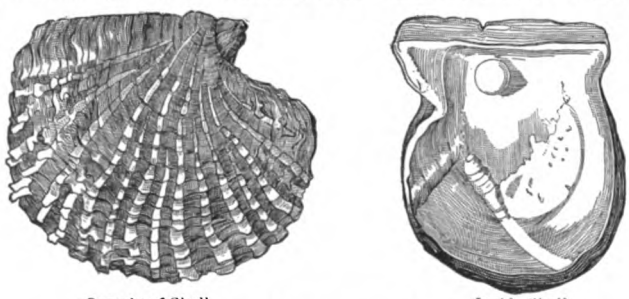
Avesta Language. Zend, the ancient East Iranian tongue; closely related to Vedic Sanskrit and Old Persian of the Persepolis inscriptions.

Avianus, FLAVIUS, ab. 400. Author of Latin fables.

Avicenna, 980–1037. Arabian philosopher and physician of Bokhara, famous in the Middle Ages. He served in the courts of different Emirs, and was at one time Vizier. Aristotle and Galen were largely introduced to the scholastic philosophy and early Italian schools of medicine through him. Many editions of his works, especially of his *Canon of Medicine*, have been published.

Avicularia. Small prehensile processes on the thecæ of some *Polyzoa*, which are shaped like a bird's head; used for seizing food. A snapping beak, worked by special muscles, has been developed on this curious organ. Some authors think them modified polyps.

Aviculidæ (PEARL MUSSELS or PEARL OYSTERS). Lamellibranchs without siphons, with unequivalved, oblique shell, having a fine inner layer of mother-of-pearl. The anterior adductor muscle is small; the foot is small and secretes a byssus. *Meleagrina* is the pearl-mussel especially, and inhabits the gulfs of the Indian Ocean and the Gulf of Mexico.



Outside of Shell. Inside Shell.

Pearl Oyster, showing Pearl.

The most famous pearl-fishery is located on the n. shore of Ceylon. The oysters are taken in the spring by divers, in ten fathoms of water. The largest pearls approach two inches in length, but the best average the size of peas. Besides the loose pearls, which are formed around a foreign object, as grains of sand, dead oyster-eggs, etc., the pearly layer all over the inside of the shell has commercial value. Great Britain uses $500,000 worth each year, ab. 3,000 tons.

Avienus, RUFUS FESTUS, ab. 380. Roman author of poems on geographical subjects.

Avignon. Ancient town of Provence, on left bank of the Rhone; incorporated into the kingdom of Burgundy; afterward a free republic; held for a time by the Albigenses, and taken by Crusaders 1226. It passed by inheritance to Charles of Anjou and to Joan of Naples; was purchased of her by Clement VI. 1348; became the seat of the papal court 1309–77, and of the anti-popes 1378–1418; was united to France 1791. It has interesting architectural monuments. Pop., 1891, 43,453.

Avila y Zuniga, LUIS D', ab. 1490–ab. 1562. Spanish historian of the German war of 1546–47.

Aviler, AUGUSTIN CHARLES, 1653–1700. French associate of Mansard, and writer on architecture.

Avitus, ALCIMUS ECDICIUS, ab. 450–ab. 525. Bp. of Vienne in Gaul ab. 490; author of a Latin epic on the Creation, the Fall, the Flood, etc., notable for its resemblance to *Paradise Lost*.

Avitus, MARCUS MÆCILIUS, ab. 400–457. Prefect of Gaul 439; emperor 455–56.

Avocet. Wading bird with palmated feet, of the genus

The Common Avocet (*Recurvirostra avocetta*).

Recurvirostra. Bill is slender, flexible, and bent upward toward the tip.

Avogadro, AMADEO, 1776–1856. Prof. of physics at Turin 1820. He announced 1811 the law that equal volumes of different gases under the same conditions of temperature and pressure contain the same number of molecules.

Avoirdupois. English standard weights for everything except medicines, precious metals, and gems, for which apothecaries' and troy weights are used:

27 11/32	grains (gr.)	= dram (dr.).
16	drams	= ounce (oz.).
16	ounces	= pound (lb.).
28	pounds	= quarter (qr.).
4	quarters	= hundredweight (cwt.).
20	hundredweight	= ton (ton).

In U. S. for some commodities the quarter weighs 100 lbs., and ton of 2,000 lbs. is used.

Award. The decision by arbitrators of a controversy submitted to them by the parties; it may be oral, unless the submission or a statute requires a writing; it must dispose of all points included in the submission and must be certain; it may be set aside for willful misconduct of the arbitrator, or for a violation of statutory requirement.

Awlwort. *Subularia aquatica*. Minute aquatic plant of the natural family *Cruciferæ*, found in N. America and Europe.

Axes of Reference. Fixed lines from which as data positions are determined.

Axil. Point above the insertion of a leaf on a stem. Lateral buds appear in this position and are said to be axillary.

Axile. Placentæ in the ovary of a flower, when placed along the sides of a central axis, formed by the adhesion of two or more carpellary leaves.

Axilla. Armpit, or space under the shoulder joint, bounded in front and behind by folds of muscle, outwardly and inwardly by the arm and chest, containing the large vessels and nerves of the arm and a number of lymphatic glands, which render injuries and operations in their vicinity dangerous.

Axioms. Self-evident truths, assumed at the basis of the several sciences. It is common in mathematics to formulate them as fundamental conditions of proof.

Axis. Line about which a body (*e. g.*, the earth) revolves.—Next to the uppermost of the vertebræ, jointed to the atlas and skull in such manner as to allow of rotation of the head.—Middle of the back of Trilobites.—Line around which the whorls of a snail's shell are turned.—In architecture, central line of a plan.

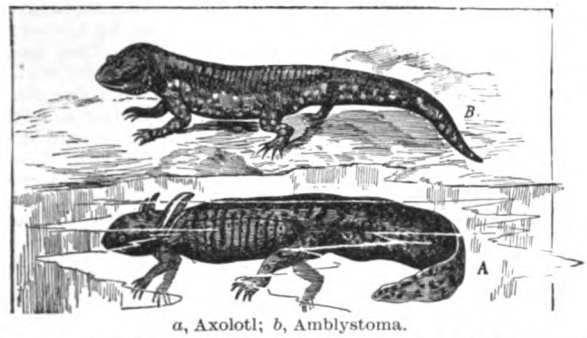
Axis. Spotted hog deer, found in India; similar to European fallow deer.

Axis of Structure. Line fixed as an element in forming a locus, as of an ellipse.

Axis of Symmetry. Line to which corresponding parts of a locus, or corresponding elements in a group of quantities, bear the same relation.

Axolotl. *Amblystoma* (*Siredon*) *maculatum* of Mexico; a

salamandrous Amphibian which usually remains in a larval state; *i. e.*, retains its gills and aquatic habit.



a, Axolotl; *b*, Amblystoma.

Axum. City of Abyssinia, once capital of Ethiopia, now mainly in ruins; celebrated for its peculiar round-topped and slab-shaped obelisks, and for its ancient Arabic inscriptions.

Ayacucho. Town of Peru, scene of a battle, Dec. 9, 1824, between the Spaniards and S. Americans. The former, though superior in numbers, were totally routed, with a loss of 2,600, and surrendered the next day. The result was the virtual independence of the Spanish settlements in S. America.

Ayala, PEDRO LOPEZ D', 1332–1407. Spanish poet, historian, and statesman. *Chronicles of the Kings of Castile.* His *Rhymes of the Palace* were written while a prisoner of war in England, and have but lately come to light.

Aye-Aye. *Cheiromys Madagascariensis.* Quadruped as large as a hare; formerly classed as a rodent, now regarded as a lemur. Inhabits Madagascar.

Ayesha, ab. 610–677. Daughter of Abu-Bekr and favorite wife of Mohammed.

Aylesford. Village in Kent where the Britons were victorious over the Saxons and Horsa was slain, 455.

Ayrer, JACOB, d. 1605. German dramatist. Sixty-six of his plays, resembling those of Hans Sachs, were pub. at Nuremberg 1618.

Ayrshire. See CATTLE.

Ayton, SIR ROBERT, 1570–1638. Scottish poet.

Aytoun, WILLIAM EDMONDSTOUNE, 1813–1865. Scottish poet and critic; prof. Univ. Edinburgh 1845. *Lays of the Scottish Cavaliers,* 1848; *Bothwell,* 1856.

Azalea. Genus of showy-flowered shrubs, of the Heath family, natives of both the Old World and the New. By some

Azalea.

modern authors regarded as of the genus *Rhododendron;* known also as False Honeysuckles.

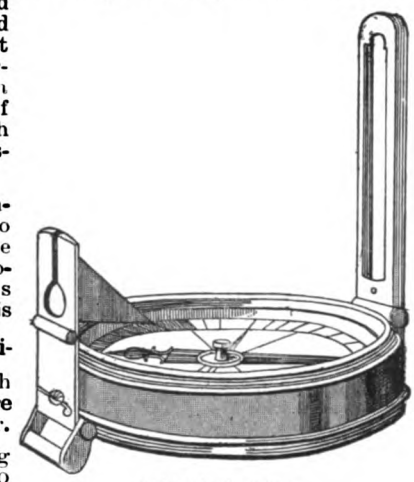
Azaleine. See FUCHSINE, which has been sold under this name.

Azeglio, MASSIMO TAPPARELLI, MARQUIS D', 1798–1866. Italian artist, novelist, and patriot; son-in-law of Manzoni, prime minister 1849–52.

Azevedo, MANOEL ANTONIO ALVAREZ D', 1831–1852. Brazilian poet.

Azimuth. Of a star, angular distance measured along the horizon from the n. or s. point of the horizon to the foot of the vertical arc passing through the star. Of a line drawn on the earth's surface, angle between the line and the meridian through one of its extremities. It is to be observed that, owing to the convergence of the meridians, the azimuths measured at the extremities will in general not be equal.

Azimuth Compass. Compass having the needle attached to a circular graduated disk and furnished with a prism, so that the eye can read bearings or azimuths of a point in the line of sight; used for rough work in reconnaissance surveying.



Azimuth Compass.

Azines. Compounds in which two aromatic nuclei are united by two nitrogen atoms. Thus the phenylene azine is $C_6H_4\begin{matrix}-N-\\-N-\end{matrix}C_6H_4$. The nitrogen atoms which furnish the union are united with each other.

Azo. Containing nitrogen. See AZO COMPOUNDS.

Azobenzene, AZOBENZOL, or AZOBENZIDE. $C_6H_5.N{=}N.C_6H_5$. Mpt. 66° C. Red crystals, prepared either by oxidation of aniline, by the removal of hydrogen from it, or from nitrobenzene by the removal of oxygen.

Azobenzoic Acid. $COOH.C_6H_4.N{=}N.C_6H_4COOH$. Three are known, prepared from the three amidobenzoic acids. See AZO COMPOUNDS.

Azo Blue. $C_{34}H_{24}N_4O_8S_2Na_2$. Sodium salt of tolidine-diazo(α-naphthol monosulphonate)$_2$. Prepared by the action of the diazo derivative of orthotolidine on naphthol sulphonic acid. It dyes cotton violet.

Azo Colors. Artificial coal-tar colors, azo compounds.

Azo Compounds. These contain as an essential feature two nitrogen atoms united in such a manner that they form a bivalent group, N=N. In ordinary azo compounds the azo group is connected to two carbon atoms. Azobenzene is $C_6H_5.N{:}N.C_6H_5$. They are very stable, and are prepared by the removal of hydrogen from the amido compounds, or of oxygen from the nitro compounds.

Azodiphenyl Blue. See INDULINE.

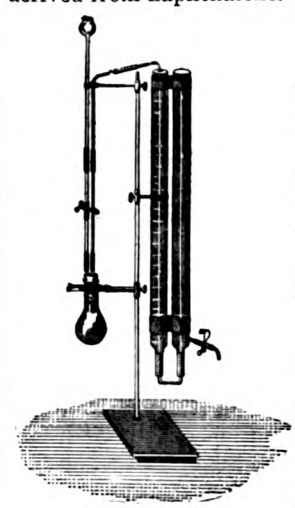
Azoflavine. A mixture of nitrodiphenylamines and nitrodiphenylamine oranges. Called also Azo Yellow.

Azoic. Strata in which no traces of life have been discovered.

Azoidaceæ. Natural family of flowering plants of the class *Dicotyledones,* including numerous insignificant herbs of wide geographic distribution.

Azoline. Dried blood, used as a source for nitrogen in the manufacture of artificial fertilizers.

Azonaphthalene. $C_{10}H_7.N{:}N.C_{10}H_7$. Azo compounds derived from naphthalene. Known in several isomeric forms. Prepared from the naphthylamines by oxidation.



Azotometer.

Azophenols. $OH.C_6H_4.N{:}N.C_6H_4OH$. Yellow crystalline compounds prepared from the nitrophenols by reduction. See PHENOL.

Azores. Group of nine islands in the e. Atlantic, belonging to Portugal since 1449. Pop. ab. 270,000.

Azote. Lavoisiers name for NITROGEN (q.v.).

Azotoluene. $CH_3.C_6H_4.N{:}N.C_6H_4CH_3$. Azo compound derived from toluene. See AZOBENZENE.

Azotometer. Knop's is based on the fact that bromine in alkaline sodic hypochlorite sets free all nitrogen from ammonium salts. The nitrogen set free in A is measured in B.

Azov, or AZOF, SEA OF. In European Russia, connected with the Black Sea by the Strait of Kertch.

Azoxybenzene. $(C_6H_5)_2{:}N_2{:}O$. Pale yellow needle formed

by gentle action of hydrogen on nitrobenzene; easily changed to azobenzene; intermediate between it and nitrobenzene.

Azoxy Compounds. Formed by gentle reduction of aromatic nitro compounds. Three-fourths of the oxygen is removed from the nitro groups affected.

Azrael. With Moslems, angel of death.

Aztec Zodiac.

Aztecs. Race of N. American Indians, who came from California or Arizona and invaded Mexico in the 12th century. They found the Toltecs in possession, who had preceded them 500 years before. At the time of the conquest by Cortez, it is probable their numbers did not exceed 250,000. They had the gens system common to the American Indians, but with certain changes; the sons inherited property, and the descent passed in the male line. The government was a military democracy; cotton was cultivated; the sun-dial was in use; and a calendar, nearly perfect, had been invented. The god of war received the chief worship; 20,000 human sacrifices were offered annually. The best houses were not over two stories, and were built of adobe, stone and gypsum.

Azuline, or AZURINE. $C_{37}H_{30}N_3Cl$. Impure hydrochloride of triphenylpararosaniline; prepared by the action of aniline upon rosolic acid; blue coloring matter.

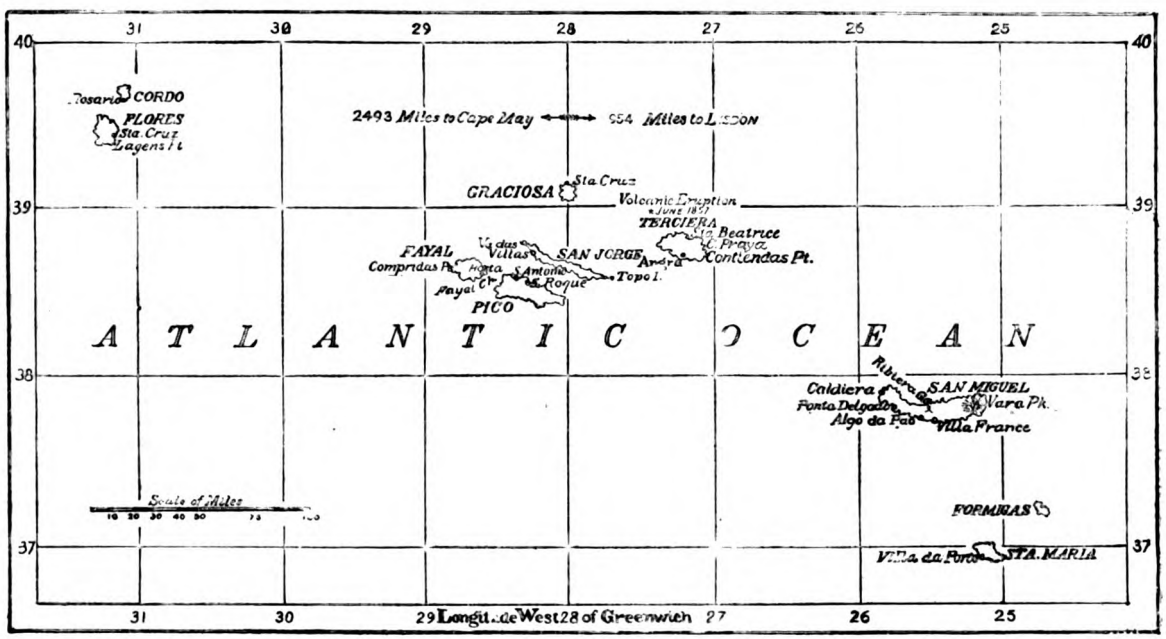
Azurite. $Cu_3C_2O_7+H_2O$. Blue hydrous copper carbonate, valuable as a copper ore when found in sufficient abundance; Chessy copper. Also iron and aluminium phosphate, more generally known as Lazulite.

Azygobranchia. Division of *Gastropoda*, including the Heteropods (*Natantia*) and Prosobranchs (*Reptantia*). This division of the *Streptoneura* includes forms that have lost their original left-side gill and excretory duct, and have the osphradium of the original right side (now on the left) developed into a parabranchia.

Azygos (AZYGOUS). Unpaired, single, or median, as the dorsal, ventral, and caudal fins of fishes; organs occurring in a sagittal plane. Also structures, or organs, on one side of the body, whose platytrope has been suppressed.

Azygosperms. Zygosperms produced by parthenogenesis in certain of the *Mucorini*.

Azygospore. Spore resembling a zygospore, but produced asexually.



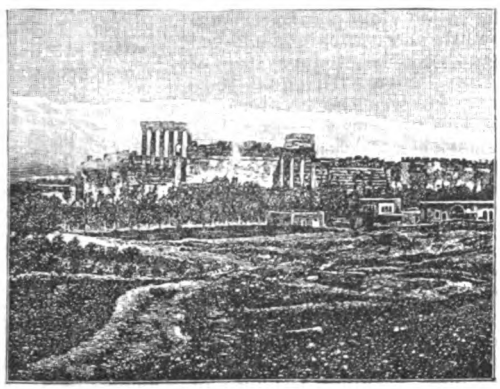
Azores. (See Article on opposite page.)

B

Baader, Benedict Franz Xaver von, 1765–1841. German theologian, prof. Univ. Munich from 1826; follower of Jakob Boehme.

Baal. Phœnician and Canaanite personification of the planet Jupiter, or the Sun, whose worship, with that of the goddess Ashtoreth, was the great corrupter of pre-exilic Israel.

Baalbek. Site of the ancient Heliopolis in Syria, between the Lebanon and Anti-Lebanon mountains, and a day's journey n. of the road from Beyrout to Damascus. Here are the most



Ruins of the Great Temple at Baalbek, with the Lebanon Range.

imposing Roman temple ruins in existence, dating from the Antonines—a temple of Jupiter and one of the Sun. The acropolis on which these buildings stood has foundations of enormous stone blocks dating from the Phœnician period. Three of them are each 64 ft. long, 15 ft. high, 15 ft. thick, and weigh about 1,100 tons each.

Babbage, Charles, F.R.S., 1790–1871. English mathematician, Cambridge 1828–39, inventor of a calculating machine, not completed. *Economy of Manufactures*, 1832; *Calculus of Functions.*

Babbitt-Metal. Alloy for lining moving surfaces in machinery which are exposed to friction of motion under pressure. Usual proportions, 91 per cent tin, 7 of antimony, and 2 of copper. It has a low coefficient of friction, a high conductivity for heat, is easily fusible, and expands on cooling so that it can be melted and poured into a bearing when renewal is necessary

Babcock, Stephen Moulton, b. 1843. American agricultural chemist, prof. Univ. Wisconsin. He has given particular attention to the chemistry of milk, and is the inventor of the Babcock Milk Test for the rapid determination of fat in milk.

Babcock's Milk Test. Pub. 1890. 17.5 C.C. milk are mixed with same quantity of sulphuric acid, 1.82 Sp. G., in test bottle with graduated neck. The albuminoids, casein, are changed to soluble albumens. The bottles are whirled in a horizontal wheel for several minutes at 200° F. The wheel has a hot water jacket. The bottles are then filled to the neck with hot water and whirled two minutes longer. The fat is read liquid at 150° F.

Babel. Tower attempted to be built after the Flood; Gen. xi. Also Nimrod's city, Babylon; Gen. x. 10.

Bab-el-Mandeb. Strait connecting Red Sea with Indian Ocean.

Baber, Zehir ed-Din Mohammed, 1483–1530. Emperor of India, descended from Timur; king of Ferghâna or Khokan 1495. He lost Ferghâna by rebellion of the nobles; conquered Samarcand and Cabul; invaded the Punjab 1505 and 1519; in 1524 again crossed the Indus, and made himself master of India 1526–27.

Babeuf, Francois Noel, 1764–1797. French journalist, who conspired to overthrow the Directory and establish a communistic republic, but was guillotined. His doctrines were revived 1828, and became an element of the later socialism.

Babi, or Babists. Persian sect; founded ab. 1844, by Mirza Ali (d. 1850); partially suppressed 1852, but still numerous. Its members urge certain humane reforms, and venerate their founder, the Bab, as above Mohammed.

Babinet, Jacques, 1794–1872. Prof. physics at Poitiers and Paris, author of many papers on meteorological subjects.

Babinet's, or Jamin's, **Compensator.** Apparatus for studying elliptically-polarized light. Two wedges of quartz of the same small angle are cut with one face of each wedge parallel to the optic axis, which in one is parallel to the edge, in the other at right angles to the edge. The two are put together so as to form a plate, the angles of the wedges being turned in opposite directions, while the optic axis in both crystals is parallel to the faces of the plates.

Babington, William, 1756–1833. British chemist and mineralogist. *New System of Mineralogy*, 1799.

Baboons. Dog-faced monkeys (*Cynocephalus*), living in troops in inaccessible or rocky heights, but descending daily to drink. They live on fruits and grubs, and defend themselves by throwing stones. The ordinary Baboon of n. Africa has a long tail, as has a species from the Cape of Good Hope, but the Drill or Mandrill of w. Africa has a stumpy tail, and peculiarly

Mandrill (*Cynocephalus mormon*).

grooved and brilliantly colored elevations on the cheeks. In Abyssinia there is the Hamadryas, or Sacred Baboon, and in the Celebes the Crested Baboon (*Cereopithecus niger*), ab. the size of a spaniel.

Babouvism. See Babeuf.

Babrius. Greek fabulist of uncertain date A.D. His poems came to light 1843–44.

Babuyan. Volcanic islands n. of the Philippines, held by Spain.

Babylas, St. Bp. of Antioch 237, martyred 250. His bones troubled the adjacent heathen worship, and were removed to Italy in the Middle Ages.

Babylon. Ancient city on both sides of Euphrates, in form

of a square, 14 m. on each side, according to Herodotus; 10½ m. according to Ctesias. It was inclosed by two walls 300 ft. high and 85 wide, outside of which was a deep moat. The walls were pierced on each side by 25 gates of brass, as also were the walls on either bank of the river. The buildings were of brick, burned or sun-dried. Its most famous structures were the Temple of Bel, 8 stages high, rising from a base 600 ft. square, and the Hanging Gardens, raised upon a series of arches ab. 75 ft. high. The Assyrians captured B. in 14th century B.C., and established a Semitic dynasty here, which continued till the accession of Nabonassar 747; Assyrians again gained supremacy 680, and retained it till fall of Ninevah 625, when Nabopolassar secured its independence. Nebuchadnezzar reigned 604–561, and built the walls, hanging gardens, and other massive structures; conquered Syria, Judea, Egypt: destroyed temple at Jerusalem 587. Cyrus took B. by stratagem 538; Alexander took it 331, and intended it for his capital, but died here 323. Seat of government transferred to Seleucia ab. 300. Long the center of Asiatic material civilization, her luxury, idolatry, and oppression called forth from Hebrew prophets threats of the desolation which has for many centuries been her fate. The name was by analogy used by St. John and St. Peter for Rome.

Babylonia. Lower portion of the region between the Tigris and Euphrates. Its early history, as given by Berosus and Herodotus, claims great antiquity. Its chief city was Babylon; it waged war with the Assyrians to the north, with varying success. Tiglath Pileser, the founder of the second Assyrian empire, conquered B. 744 B.C. It was under Assyrian sway until the revolt of Nabopolassar 625. His son Nebuchadnezzar (604–561) was master of a great empire. This was overthrown later on by the Persians under Cyrus, who merged it in his empire. Remains unearthed show that the arts had reached considerable development. The cuneiform inscriptions upon brick cylinders are being rapidly deciphered, and give much information regarding the religion, mythology, daily life and history of the Babylonians. Americans are actively interested in this work, and Univ. Pa. has sent two expeditions to explore its ruins.

Babylonian Architecture. Brought to light by the researches of Layard and Rawlinson. It strongly resembles Assyrian in the plans and purposes of the buildings. The main difference is that no stone was used in these, which are entirely of clay, either sun-dried or burned in kilns, and for decorative purposes enameled with colored glazes. The principal buildings of which the ruins have been found and explored are the Kasr, built of brick, bearing the stamp of Nebuchadnezzar, ab. 600 B.C., on an artificial mound on the e. bank of the Euphrates; and the Birs Nimroud, a pyramid in six receding stories or terraces, averaging nearly 20 ft. in height, and in plan a square of some 280 ft. at the base; supposed to have been the chief temple of Chaldean worship.

Babylonian Captivity (SO-CALLED) OF THE CHURCH, 1305–1377, when Rome was deprived of her Pontiff, the Popes residing at Avignon.

Babyroussa. Horned hog; found in Java, Borneo, and Molucca Is.

Baccalaureate. Graduate or bachelor of arts; also sermon before college commencement.

Baccarat. French game of cards, played upon an oval table, with 12 marked divisions, 6 on each side of the banker, opposite to whom is an assistant or croupier. The bank is sold by auction to the highest bidder. The players draw for places, the lowest sitting at the right of the banker and so on. Three packs of cards are shuffled together and cut. Each player places his bet in front of him. The first players on the right and left of the banker play for their respective sides until they lose, when the two next follow until they lose, and so on. The banker deals a card to the right hand player, then to the left, and then to himself, and then repeats the deal. The object is to make 9, the court cards and tens are Baccarat or zero and are not counted, and also 10 in the score, thus if the two cards count 12 it is called 2. If the player has 4 or less in the two cards he must take another card, if he has 6 or more, he must decline a card. If he violates the rule, he must pay all the bets of his side of the table. If the two cards add up 8 or 9 it must be declared. Only one card can be drawn in addition to the first two. The banker pays or is paid according to the hands; in case the hand is equal to his own, neither the player nor himself wins.

Bacchanalia. Feasts of Bacchus, celebrated by night with great disorder and licentiousness; forbidden at Rome 186 B.C.

Bacchantes. Females who celebrated the festivals of Bacchus with wanton and frenzied rites.

Bacchus. Son of Jupiter and Semele, the daughter of Cadmus; god of wine. After his return from an expedition to India, he instituted at Thebes festivals for women, which gradually became more wild and dissolute. He is represented as a voluptuous youth, with a form approaching the feminine.

Bacchus.

Bacchylides, OF KEOS. Greek lyric poet of 5th century B.C., a rival of Pindar.

Bach, JOHANN SEBASTIAN, 1685–1750. German composer, most eminent of a family long noted as musicians; organist at Arnstadt, Mühlhausen, and Weimar 1703–15; Chapelmaster at the court of Anhalt-Cöthen 1716–22. In 1723 he went to Leipsic and became Cantor of the St. Thomas School and director of the music in four churches. He was unequalled as an organ and clavichord player, a master of the technical part of violin playing, knew thoroughly the structure of the organ, invented an instrument midway between the violoncello and viola, called viola pomposa, combined the lute and cembalo in a keyed instrument, and invented a system of tuning the clavier with equal temperament. He was the greatest of all fugue writers and the father of the modern art. His chief works are the *Mass in B minor; Passion according to St. Matthew; The Organ Fugues;* and *Well-Tempered Clavichord.*—Of his sons, WILHELM FRIEDEMANN, 1710–1784, was the leading organist of his time; KARL PHILIPP EMANUEL, 1714–1788, was a composer, author of a book on the piano, and court musician to Frederick II. of Prussia 1740–67; JOHANN CHRISTIAN, 1735–1782, was organist in Milan and later in London.

Bache, ALEXANDER DALLAS, LL.D., 1806–1867. Great grandson of Benjamin Franklin; prof. Univ. Pa. 1828; pres. Girard College 1836, where he established a magnetic and meteorological observatory; superintendent U. S. Coast Survey from 1843; first pres. National Academy of Sciences 1863. *Magnetic Observations made at Girard College,* 3 vols., 1840–47; *Lectures on Switzerland,* 1870.

Bachelor's Buttons. Double-flowered forms of Buttercups, often planted for ornament. Also *Centaurea nigra,* a weed of the Composite family.

Bachet, CLAUD GASPARD, 1581–1638. French mathematician. First to solve indeterminate equations by continued fractions. *Problèmes Plaisants,* 1612.

Bachman, JOHN, D.D., LL.D., 1790–1874. American naturalist. He co-operated with Audubon, especially in the *Quadrupeds of North America,* 1846–50.

Bacillariaceæ. See DIATOMACEÆ.

Bacilli. See MICRO-ORGANISMS.

Bacillus. Genus of rod-shaped BACTERIA (q.v.).

Bacillus tuberculosis. Germ whose diameter is about $\frac{1}{80000}$ of an inch and whose length varies up to ab. $\frac{1}{8000}$ of an inch. It breeds in the tissues of warm-blooded animals, and there produces tubercles that gradually break up and pass their germ contents into the blood, so that the disease often becomes transported to other organs. When the tubercle breaks into an air passage in the lungs, the germs are coughed up, and when dried are taken up by the air as dust, and so may infect other animals or man. The diagnosis of this germ by microscopic examination is usually difficult, especially when present in milk, unless so abundant as to average one germ per drop. To prove its presence it is needful to subject the sample (of sputum from a consumptive, *e.g.*, first dried on a glass slide and heated), to a prolonged action of a powerful aniline dye, like fuchsin or gentian violet, at ordinary temperatures, and at 212° F. a few minutes may suffice. Then the slide must be washed in 30 per cent nitric acid until apparently decolorized. This takes the color out of ordinary bacteria, but not out of the tubercle germ. Washing in water follows, and usually a staining with a complementary color of the other objects on the slide is practiced, to help in seeing the germs. A magnifying power of over 600 diameters is needed to see them satisfactorily.

Back. Changes in the direction of the wind when they occur in the order e., n., w., s., *i.e.*, against the diurnal course of the sun as seen from northern latitudes; or against the motion of the hands of a watch, when laid horizontally face up.

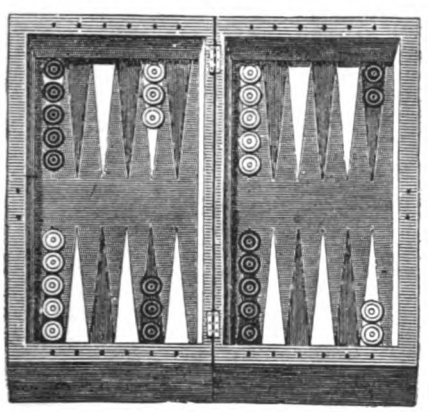
Back, Sir George, 1796–1878. English navigator, who sailed with Sir John Franklin 1819, and in 1833 led an expedition in search of Capt. Ross.

Back-acting Engine. One in which the cross-head and the main shaft of the engine are at opposite ends of the steam-cylinder, or in which the connecting-rod or rods are carried backward from the cross-head instead of forward to connect the latter to the crank or beam-pin. Such engines are designed to secure compactness, as the length of the connecting-rod (over four cranks in length), is subtracted from the sum of the lengths of the cylinder-casting and of the piston-rod (which will be over twice the stroke), instead of being added to that sum, to get the entire length of the mechanism.

Back-connection. In a marine boiler, or in the setting of an externally-fired return stationary boiler, the part of the flue-passages in which the smoke or hot gases pass upward from the combustion-chamber behind the grate or fire-box, in order to come forward through the tubes or flues in the water-space to the front end of the boiler. The English call it the "back uptake."

Backergunge, or Bakarganj. A fertile district of 3,649 sq. m., pop. 1,900,889, on lower Ganges and Bramapootra, India, n. of the Sunderbunds.

Backgammon. Said to have been invented in 10th century. Game played by two persons with pieces on a board with 24 divisions according to the throws with two dice. Two principal games are played in Europe and America, one in which the pieces, 15 on each side, are set on certain points on the board at the commencement of the game, and the other, called Russian or Trictrac, in which they are not thus set, but each



The Backgammon Table.

player enters his pieces at the beginning at the same table and moves in the same direction. The game is common in China under the name of *shéung luk*, "double sixes" (in Japanese, *sugoroko*), and is played in Siam under the name of *saka*, with a little tower into which the dice are thrown in the manner described by Greek and Latin authors.

Back-Gear. In an engine-lathe for metal turning or in a drill or milling machine, a short shaft parallel to the spindle which carries the nest of cone-pulleys. On this short shaft are two or three toothed wheels. The cone-pulley casting which carries the belt has cast or fastened to it a small gear which engages with a large gear on the back-gear shaft. The cone-pulley casting turns freely on the spindle. At the other end of the back-gear shaft is a small gear which engages with a large gear keyed on the spindle of the tool, so that the driving speed and power of the belt is carried round the nest of cone-pulleys back to its axis again with great reduction in speed and increase of power. The usual ratio of gain is as 1:10 or as 1:16. In lathes which are triple-geared there is a third wheel on the back-gear shaft, so that at will the spindle may be driven by the former gear, or the face-plate or chuck-plate may be driven from teeth on its periphery, by this third wheel. See Lathe.

Backhuisen, or Bakhuysen, Ludolf, 1631-1700. Dutch marine painter.

Backing. Rubble masonry used in the middle part of a pier or at the back of a wall, consisting of small rough stones.

Back Stay. Rods or chains which run from the top of a tower of a suspension bridge backward to an anchorage.

Backus, Isaac, 1724–1806. Historian of the Baptists in New England, 1777–96.

Backwater. Rise of water in a stream, due to construction of a dam, or to obstruction by piers. In such case the water surface at points several miles up stream from the dam is often much elevated. The curve of this backwater has been investigated by hydraulic engineers, and tables have been constructed for facilitating computations.

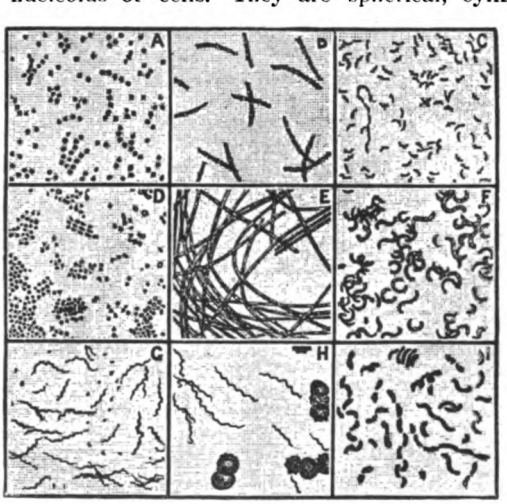
Bacon, Francis, 1561-1626. English lawyer and philosopher, son of Sir Nicholas (1509–1579), Keeper of the Seal. He climbed slowly under the patronage of Lord Burghley and the Earl of Essex; M.P. 1584. Under James I. he became Attorney-General 1613, Privy Councilor 1616, Lord Chancellor 1618, Baron Verulam 1618, Viscount St. Albans 1621; convicted of bribery and removed from office 1621; celebrated for his *Essays*, completed 1612; *Apothegms*, *History of Henry VII.*, and several miscellaneous works. His chief fame rests upon his philosophical treatises, which show him to be one of the greatest thinkers that ever lived. He endeavored to refound the study of science upon the basis of inductive reasoning, thus becoming the forerunner of modern investigation. This portion of his works is classified under the heads of the *Instaurstio Magna*, which were: *Partitiones Scientiarum*, a survey of science; *Interpretatio Naturæ*, or the new method represented in the *Novum Organum*; *Historia Naturalis et Experimentalis*, a collection of facts for use in applying the method; *Scala Intellectus*, types of study; *Prodromi*, a training for *The New Philosophy*; *Works*, 7 vols., 1870.

Bacon, Leonard, D.D., LL.D., 1802–1881. Pastor in New Haven from 1825. *Genesis of the New England Churches*, 1874. —His sister, Delia, 1811–1859, originated and urged the theory that B. wrote Shakespeare's plays. (*Putnam's Mag.* 1856.)

Bacon, Roger, ab. 1214–1294. English Franciscan of genius and rare scientific attainments, who endured much persecution and was in prison as a magician from ab. 1278; so far beyond his age that his memory has been encumbered with legends, and he appears a figure of romance rather than reality. He devoted much attention to physics and chemistry. His *Opus Majus*, ab. 1266, was pub. 1733, and some of his treatises 1859.

Bacon's Rebellion. Uprising in Virginia 1676 under the lead of Nathaniel Bacon, a planter, who asked permission to take measures for defense against the Indians, whose movements seemed to threaten the extermination of the whites. Though this was not granted, he gathered his forces and won two signal victories, one of them at "Bloody Run," in the present bounds of Richmond. Bacon extorted from Gov. Berkeley a major's commission, a letter to the king exculpating himself and followers, the repeal of some statutes, and the enactment of others. As Berkeley soon reversed this action, and proceeded against Bacon as a rebel, Bacon captured and burned Jamestown, the governor taking to his fleet. Bacon's career was cut short by his death Oct. 29, 1676. His motives seem to have been pure and patriotic, and his rebellion to have had abundant justification in the condition of the colony. After his death the people still sought the re-enactment of "Bacon's laws."

Bacteria. Minute organisms, apparently related more nearly to plants than to animals, but perhaps to be regarded as representing a more primitive order of life than the other kingdoms, in that they are the homologues of the nucleus or rather nucleolus of cells. They are spherical, cylindrical,



Different Kinds of Bacteria (mostly after Koch):

A, Micr coccl, in drinking-water; B, in splenic fever; C, in cholera (Koch); D, from surface of water; E, in splenic fever (in thread-form, and with incipient spores); F, Spirillum, from putrefaction; G, Spirochæte, from the teeth; H, in relapsing fever, from blood; I, different forms of cholera microbe (Koch).

curved or spiral in shape, and multiply by growing in the direction of the longer axis and then breaking into two equal parts; some also reproduce by spores. Some can swim actively

by means of flagella, and all produce chemical decompositions of their food before it is absorbed or assimilated. In this way we get various fermentations, putrefactions, etc., of organic substances, that but for the presence of these germs would remain unaltered. Examples of such changes are: the souring of food (such as milk), spoiling of meat, etc. As parasites in living organisms (the decomposition products acting as poisons), they produce diseases. (See DISEASE GERMS and GERM DISEASES.) Bacteria cause the decay of fallen trees, leaves, etc., and thus prepare the food of plants. Many bacteria are useful to man; the ripening of cream and of cheese, producing the proper flavor, is due to their presence. Even in their mission of destruction, acting as pestilence or plague visitations, they come only as punishments for violated hygienic law; as a result, the weaker members of society are weeded out, thus causing human progress. The genera are *Micrococcus*, *Bacterium*, *Bacillus*, *Spirillum*, *Vibrio*, etc. The *Coccus* forms and *Bacilli* are very numerous, nearly 500 species having been described.

Bacteriaceæ. Order of *Schizomycetes*, including the genera *Bacterium* and *Bacillus*.

Bacteriopurpurin. Red pigment contained in certain *Schizomycetes*.

Bacteroids. Minute organisms resembling bacteria, or, more probably, a kind of bacteria. They exist in the root-tubercles of *Leguminosæ* and in the soil.

Bactria. Eastern province of Persian Empire, conquered by Alexander 327 B.C.; governed by Seleucidæ till 255 B.C., when it revolted and formed an independent Greek kingdom, which was gradually orientalized. Its history has been partly recovered through its coins.

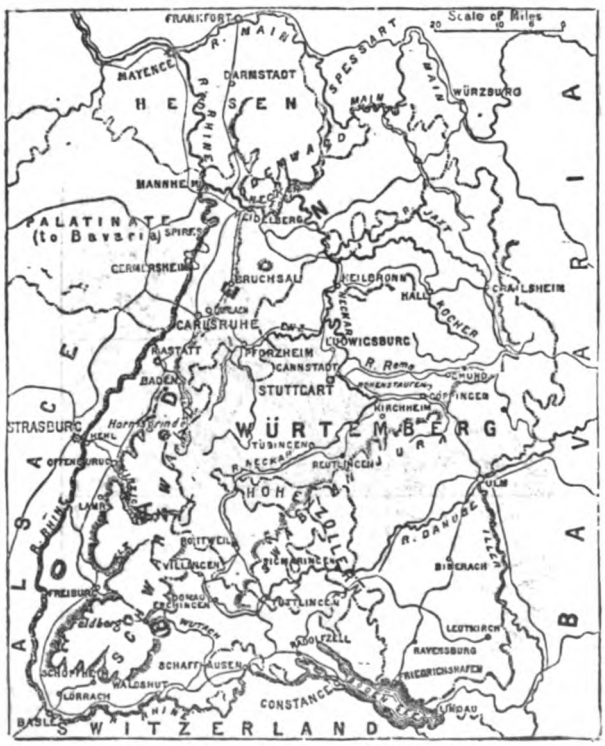
Bactrian Camel. See CAMEL.

Baculite. Fossil cephalopod resembling a straightened Ammonite; very abundant in some of the Jurassic beds of the West, as in the Bad Lands.

Badajos. Fortified city in s. w. Spain, taken by French under Soult March 11, 1811; invested by British under Wellington March 16, 1812, stormed and taken April 6. Pop., 1887, 27,279.

Badeau, ADAM, 1831–1895. U. S. Consul General at London, 1870–81, and Havana 1882–84. *Military History of U. S. Grant*, 1867–81; *Aristocracy in England*, 1886.

Baden, GRAND DUCHY OF. State of Germany, extending along e. bank of the Rhine. The country is somewhat broken, with broad fertile valleys; area 5,823 sq. m. It has considerable manufactures, of a very varied nature, and a large trade. Its educational institutions are celebrated. The government is a constitutional monarchy. The grand dukes are descended from the Counts of Zähringen. Herman II., 1074, was the first markgraf. B. became an electorate 1803, a grand duchy 1806, and a part of the German Empire 1871. Pop., 1890, 1,656,817.

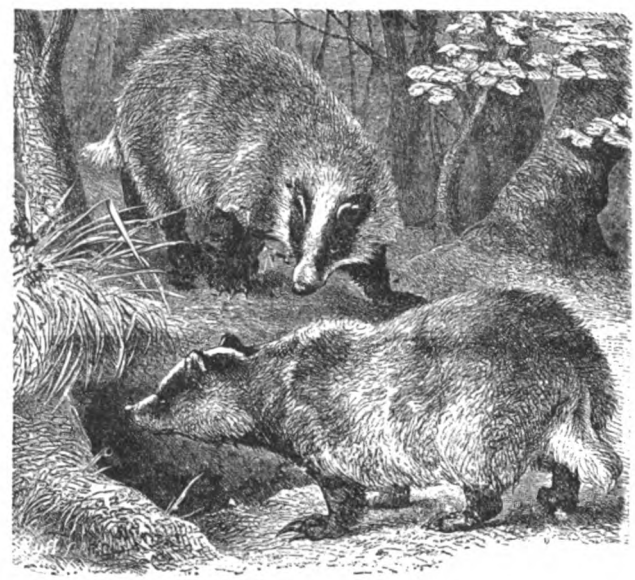


Sketch Map of the Grand Duchy of Baden.

Baden, TREATY OF, Sept. 7, 1814. Ending the war of the Spanish Succession.

Baden Baden. Watering place in Baden, noted for its hot springs, and till 1871 for its gaming-tables. Pop. ab. 14,000.

Badger. *Meles vulgaris*, common in Europe; *Taxidea americana*, abundant in the western U. S.; both belong to the sub-family *Melinæ*. They burrow in the earth, are monogamous, and have three or four young in early summer. Legs are short, feet plantigrade, and body appears broad and flat when the fur is lying down. They are shy, but when cornered are ferocious. American badger lives largely on ground squirrels, which it can dig out with great rapidity. In northern latitudes it hibernates. In Asia and Africa are the honey badgers or ratels, which rob bees' nests. They constitute the sub-family *Mellivorinæ*.


Badger (*Meles taxus*)

Badia y Leblich, DOMINGO, 1767–1818. Spanish traveler. *Ali Bey in Africa and Asia*, 1814.

Bad Lands. Portions of the western U. S., desert from lack of irrigation.

Badminton. Kind of lawn tennis, so called from the seat of the Duke of Beaufort in England; played with shuttlecocks instead of balls, the rackets being the same as in lawn tennis.

Baedeker, KARL, 1801–1859. Founder of a German publishing house well known for its guide-books, at Leipsic.

Baer, KARL ERNST VON, 1792–1876. Member of the Imp. Acad. Sci., St. Petersburg. Authority on the climate of Russia and Siberia.

Baer's Law. Generalization announced by von Baer in 1860, that in the rivers of Russia and the whole northern hemisphere, whenever they flow n., deposits and banks are made most frequently on the right side of the stream owing to the influence of the rotation of the earth on the moving water.

Baeyer, JOHANN JACOB, 1794–1835. Chief of geodetic staff of Prussia; founder and pres. of the commission on International European Measurement of a Degree; author of works on Atmospheric Refraction, Hypsometry, etc.

Baffin's Bay. Arm of the Atlantic, between Greenland on the e. and Baffin's Land, North Devon and other Islands of Arctic N. America on the west.

Baffin's Land. Island in n. e. N. America, w. of Davis Strait and n. of Hudson Strait.

Baffin, WILLIAM, 1584–1622. English navigator, who made an Arctic voyage with James Hall 1612, and discovered Baffin Bay 1616.

Baflote. Natives of Loango, n. of the Congo; brown-skinned, of fine figure, but face spoiled by the over-flat nose; sensual, but cleanly and temperate; superstitious, imaginative, suspicious and treacherous; noted for their loquacity and hasty temper. The girls choose their husbands. Their religion is a mixture of monotheism and fetichism. The marriage ceremony consists in the bride's cooking two trial meals, which, if the

husband eats, the knot is considered as tied. All possessions are inherited in the female line. Slaves are treated as members of the family.

Bagasse. Solid material left in the press after the juice has been pressed from sugar cane; used as a fuel.

Bagatelle. Game resembling billiards, played on a smaller table, having nine numbered holes at one end. Nine balls are used, two of which are colored. One of the latter is placed on a spot in front of the holes, and the players in turn play eight balls, the colored one first, endeavoring to drive them into the holes by striking them with cues. The red balls count double, and the object of the game is to score the highest sum of the numbered holes.

Bagdad. City on the Tigris, formerly capital of the Caliphs; founded by Al Mansur ab. 762; enlarged by Haroun Al Raschid ab. 800. Sacked by Tartars 1258; taken by Turks 1638. Pop. ab. 180,000.

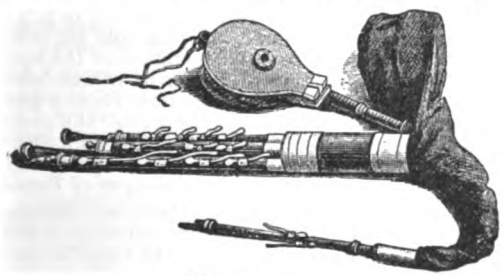
Bagehot, WALTER, 1826–1877. English author. *Economist*, from 1859; *English Constitution*, 1867; *Physics and Politics*, 1872; *Lombard St.*, 1873; *Depreciation of Silver*, 1877; *Studies*, 1879–81.

Baggesen, JENS, 1764–1826. Danish poet, who wrote also in German.

Bagpipe. Rude instrument of music, now found chiefly in Scotland, based upon a primitive employment of the organ

Highland Bagpipe,

principle. Pipes with reeds are sounded by a bellows in the shape of a bag, which is filled with air either by blowing, or mechanically by means of smaller bellows worked by the arm.



Irish Bagpipe.

It is of great antiquity, being mentioned in Daniel iii. 3. Its Chaldee and Greek name is tr. "dulcimer" in the English Bible.

Bagshot Beds, or SANDS. Occur in the Lower Tertiary of the British Isles. Consist chiefly of sand alternating with clay. Mostly unfossiliferous, except in the Hampshire basin, where a large series of marine organisms have been found. Attain thickness of 600 ft.

Bagradites. Family of Jewish origin, who ruled in Georgia 574–1424, and in Armenia 748–1079.

Bagration, PETER, PRINCE, 1765–1812. Russian general of Georgian descent, prominent in the Napoleonic wars.

Baguios. Spanish name of tornadoes near the Philippine Islands.

Bahamas. Ab. 700 islands and keys of the West Indies, belonging to Great Britain. Few of them are inhabited. They produce mainly tropical fruits. The capital is Nassau, on New Providence. Pop. 48,000.

Bahia. City and seaport of Brazil, on Bay of All Saints. It has an excellent harbor and a large commerce. Pop. 180,000.

Bahrám, or VARAHRÁN. Five kings of Persia: I. Grandson of Sháhpúr, 274–277; II., 277–294, had wars with Rome; IV., 389–399, kept peace with Rome and tolerated Christianity; V., Known as Gór (Wild Ass), a hero of Persian tradition, ruled 420–438; and waged war which ended 422 in securing toleration to Christians in Persia and to Zoroastrians in the Byzantine empire.

Baif, JEAN ANTOINE DE, 1532–1589. French poet and translator.

Baikal. Lake in s. Siberia. Its outlet is by the Angora and Yenesei Rivers. Length 400 m., breadth 40 m.

Bail. Security for one's appearance in court. A person arrested in a civil action, except under final process, has an absolute right to give bail; also generally in a criminal action, if the offense is not capital. The obligation entered into by the sureties for the arrested person's appearance is called a bail bond. American Constitutions generally prohibit excessive bail.

Bailey, JAMES MONTGOMERY, 1841–1894. Humorist; ed. *Danbury* (Conn.) *News*.

Bailey, LIBERTY HYDE, b. 1858. American horticulturist and editor. Prof. Cornell Univ. Ed. *American Gardening*; author *Annals of Horticulture, Nursery Book, or Hand Book of Plant Propagation and Pollination*, etc.

Bailey, PHILIP JAMES, b. 1816. English poet. *Festus*, 1839.

Bailey, THEODORUS, U.S.N., 1805–1877. Prominent in the taking of New Orleans, April, 1862; commodore 1862; admiral 1866.

Bailiff. (1) A sheriff's officer or deputy who serves processes and makes arrests. (2) The manager of another's lands and goods.

Baillie, JOANNA, 1762–1851. Scottish poet and dramatist.—Her brother, MATTHEW, M.D., 1761–1823, was a noted anatomist.

Baillon, HENRI ERNEST, b. 1827. French botanist. *Botanical Dict.*, 1876–92; *Families of Plants*, 1867–95.

Bailly, JEAN SYLVAIN, 1736–1793. French astronomer; Academician 1784; pres. States-General and mayor of Paris 1789. His *History of Astronomy*, 4 v., 1775–83, is written in a graceful, pleasant style, but has little solid value. He d. by the guillotine.

Bailment. Delivery of personal property for a special purpose, to be returned when the purpose is accomplished. It may be (1) for the sole benefit of the bailor, (2) for that of the bailee, or (3) for mutual benefit. Bailees of the first class are bound to slight care only; of the second, to the greatest care; of the third, to ordinary care, except inn-keepers and common carriers, who are absolutely bound to deliver over the property bailed, unless prevented by the act of God, of the law, of the bailor, or of a public enemy.

Baily, FRANCIS, D.C.L., 1774–1844. English astronomer. His chief services are the determination of the density of the earth by the method of Cavendish, the superintendence of the British Assoc. Catalogue of stars, and of the publication of Lalande's *Histoire Celeste*.

Bain, ALEXANDER, LL.D., b. 1818. Prof. Univ. Glasgow 1845, Aberdeen 1860, rector 1881; author of text-books of mental philosophy and *Life of James Mill*, 1881.

Bainbridge, WILLIAM, U.S.N., 1774–1833. Commodore 1812, in command of the "Constitution"; awarded a medal for the capture of the British frigate "Java," Dec. 1812; naval commissioner 1823.

Baird, HENRY MARTYN, Ph.D., LL.D., D.D., b. 1832. Historian of the Huguenots; prof. Univ. N. Y. from 1859.—His brother, CHARLES WASHINGTON, D.D., 1828–1887, wrote *History of the Huguenot Emigration to America*, 1885.—Their father, ROBERT, D.D., 1798–1863, agent of several societies, wrote histories of the Waldenses and of Temperance Societies.

Baird, SPENCER FULLERTON, LL.D., 1823–1887. American naturalist; prof. Coll. Physicians and Surgeons, N. Y., 1841–50; asst. sec. Smithsonian Inst. 1850; sec. 1878. He wrote much, especially on the Birds and Mammals of N. America.

Baireuth, or BAYREUTH. City of Bavaria, noted for the Wagner theater, completed 1875. Pop., 1890, 24,364.

Baireuth Festival. See WAGNER, RICHARD.

Baius, or de Bay, MICHAEL, D.D., 1513–1589. Flemish theologian; prof. at Louvain 1551; opponent of the Jesuits.

Bajazet. See BAYAZID.

Baker, SIR BENJAMIN, F.R.S., LL.D., b. 1840. English civil engineer, designer of the great Forth Bridge and the London underground railway; author of *Long Span Bridges*, 1867.

Baker, SIR HENRY WILLIAMS, 1821–1877. English hymnist; editor of *Hymns Ancient and Modern*, 1861, '68, '75, the most widely circulated of hymnals.

Baker, IRA OSBORN, b. 1853. Prof. of civil engineering Univ. Illinois since 1874; author of *Masonry Construction*, 1889, *Engineering Instruments*, 1892.

Baker, SIR SAMUEL WHITE, 1821–1893. English explorer in Africa, discoverer of Lake Albert Nyanza, 1864. *Ceylon*, 1854–55; *Nile Tributaries of Abyssinia*, 1867; *Ismaila*, 1874; *Cyprus*, 1879; *Wild Beasts*, 1891.

Baker, WILLIAM MUMFORD, 1825–1883. American novelist. *Inside*, 1866; *The New Timothy*, 1870; *His Majesty Myself*, 1879; *Blessed St. Certainty*, 1881; *Ten Theophanies*, 1883. He was a Presbyterian pastor.

Baker's Creek, MISS., BATTLE OF. See CHAMPION HILLS.

Bakewell, ROBERT, 1725–1795. English agriculturist and breeder of live stock. The first to systematically practice in-and-in-breeding. He greatly improved the Leicester sheep, the Long-Horned cattle, and the English Cart-horse.

Baking Powder. Compound of cream of tartar, sodium bicarbonate, and flour or starch. Many other ingredients are used, particularly acid calcium phosphate, alum and ammonium bicarbonate. Carbonic acid is set free, which puffs up dough, with which it is mixed, and renders it porous and light. Alum makes the bread whiter.

Baku. Town on Caspian Sea, s. of Caucasus Mts., taken from Persia by Russia 1806, connected by rail with Black Sea 1883; surrounded by oil-wells, whose production has of late been enormously developed; 24,381,139 bbls. 1893. Pop., 1886, 45,679, since greatly increased.

Bakunin, MICHAEL, 1814–1876. Russian Nihilist, in Siberia 1855–60. He urged "destruction of everything as now existing, good with bad."

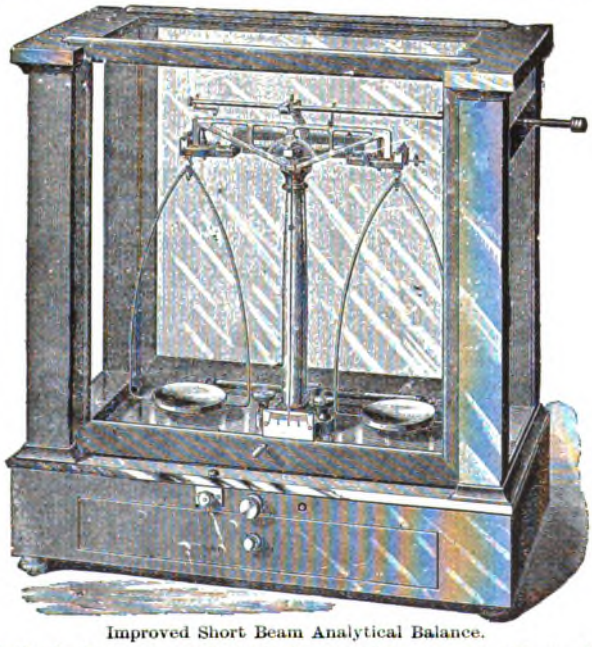
Balaam. Seer and soothsayer, living between the Jordan and Euphrates; procured by Balak, king of Moab, to curse the hosts of Israel when about to enter Canaan, but constrained to bless instead. Numbers xxii.–xxiv.

Balaclava (CRIMEA), BATTLE OF, OCT. 25, 1854. The Russians took some redoubts, but were repulsed by the English heavy cavalry, after which, from a misunderstanding of Lord Raglan's order, occurred the gallant "Charge of the Six Hundred," 198 only of 670 returning. Here also, March 22, 1855, the Russians were repulsed with loss of 2,000, the allies losing 600.

Balæniceps (SHOE-BILL). African bird related to the Herons, 5 ft. high, with stork-like legs, gray color and an enormous beak, broad and long, the upper mandible with a hook at the tip and ridge along the culmen, like the keel of a boat. There is one pair of powder-down patches. The furculum is strongly ankylosed to the keel of the sternum. They live in flocks on river banks, and nest on islets; feed on fish, watersnakes, and carcasses of dead animals.

Balaguer, VICTOR, b. 1824. Spanish poet and dramatist, prof. at Barcelona 1855; historian of Catalonia 1878, and of the Troubadours 1878–80.

Balance. Apparatus for weighing bodies, *i.e.*, comparing their masses with that of a standard. It consists of a lever called the "beam," usually of metal, and having the fulcrum vertically above and near to the center of gravity. At the extremities of the beam, scale-pans are suspended in which to



Improved Short Beam Analytical Balance.

put the body on one side and the weights on the other. The axis of rotation of all the movable parts are steel or agate "knife-edges" bearing on plates of the same material. A needle or pointer, called the index, is fixed to the beam and oscillates with it in front of a graduated scale. When the beam is horizontal the index points to zero. As a means of subdividing the smallest weight, *e.g.*, a milligram, a little bent platinum wire, called the "rider," is sometimes set astride the beam, the effect being equal to its weight and to its distance from the fulcrum. The sensitiveness of the balance is given by the formula, $\tan \delta = \frac{L\ x}{M\ h}$, in which L is the length of each arm, M the mass of the beam, h the distance from its center of support to its center of gravity, x a small excess of weight on one side, and δ the angle of deflection from the horizontal.

Balance of Power. The rudimentary international law of the Middle Ages was based on the idea that there was a common superior over all States, as the Pope or Emperor, whose commands were to be obeyed in disputes between subordinate states in the family of nations. This idea originated in the universal sovereignty of Imperial Rome. The modern idea of territorial sovereignty was formulated in the great work of Hugo Grotius, *De Jure Belli ac Pacis* (1625), and its leading principles were formally recognized in the Peace of Westphalia (1648), from which modern international law may be said to have its origin. By this instrument the territorial character of sovereignty and the equality of States in the eye of the law were recognized. The modern doctrine of the Balance of Power has in view the preservation of territorial sovereignty by recognizing the right of interference on the part of the great European powers to check the ambitious designs of great nations which, by the acquisition of territory, would disturb the existing distributions of power among European States. It does not apply to economical and strictly internal growth, nor to colonial establishments, nor to increase in sea power. The preventive policy of this doctrine has been the pretext of the most bloody and destructive wars waged in modern times: thus the balance of power adjusted by the Peace of Westphalia was disturbed by the ambition of Louis XIV.; again by the successive coalitions formed by the great European monarchies against France in the revolution of 1789, in which the latter contended for the principle of non-intervention. The Holy Alliance (1815), at first indefinite in purpose, ultimately became a league of absolutist sovereigns for putting down by force, if necessary, all movements in favor of political liberty among Continental States. The general ferment among the populations of Continental States in 1820 giving rise to the revolutions in Spain, Portugal, Naples and Piedmont, was suppressed by a violation of the principles of non-intervention against which Great Britain properly protested. And the design of the Confederated Sovereigns belonging to the Holy Alliance to reconquer for Ferdinand VII. of Spain the revolted Spanish colonies in America led to the promulgation of the Monroe Doctrine (Dec. 2, 1823), by which the prevailing principle of interference in Europe was met with an opposing principle on this side of the Atlantic. The most memorable instances of the application of the principle of the balance of power in recent times have been the interposition of England, Austria, Prussia and Russia in 1840, which forced Mehemet Ali to renounce the provinces of the Turkish Empire of which he held possession, and that of France, England and other powers in 1854 to preserve the integrity of the same empire against the designs of Russia.

Balance of Trade. Difference between value of merchandise exported from, and of that imported into, a country, favorable or unfavorable, according as the exports exceed the imports, or vice versa.

Balanced Valves. When the fluid in two chambers is under very different pressures, and the opening in a partition which separates the chambers is closed by a valve, that valve can be opened only by overcoming the resistance offered by the excess of pressure on its upper side. A balanced valve is one in which this pressure on the back of the valve is equalized by another pressure which tends to lift the valve off its seat. Valves open either by lifting off their seats or by sliding over them. Lifting-valves are usually balanced by giving two seats to a double valve on one spindle, the pressure acting in opposite directions on the two discs. Such valves may be perfectly balanced, or one disc may be of larger area than the other, to insure that the closed valve shall be held shut by excess of pressure. Sliding-valves are balanced for steam-engines by the use of a piston or flexible diaphragm of calculated area, on which the fluid pressure comes in the opposite direction from that which presses the valve to its seat; by arranging the valve to take steam internally with a calculated area receiving the equalizing pressure; or, by the use of the piston-valve in one of its forms. The piston-valve appears either as a circular disc fitting a bore steam-tight and receiving equal pressures on its ends, or else as a rectangular block sliding under similar conditions under a shield or a "pressure-plate," the latter being adjustable as the block and seat may wear.

Balanoglossus. Worm-like animal, body covered with cilia, contractile proboscis, at base of which is a collar, in front of the mouth; branchial region, resembling that in the lowest

vertebrates; genital region, gastric and hepatic viscera, and ringed, caudal region, at end of which is the anus. Larva is known as a tornaria, and resembles that of the starfish. It has præ-oral, post-oral, and præ-anal bands of cilia. The body cavity is formed from two pairs of archenterie diverticula. This worm burrows in the sand and is of great zoölogical interest, as a connecting link between the vertebrates and echinoderms, a relationship otherwise not even suggested.

Balanoglossus clavigerus.

Balanoids. Sessile Cirripedes of which *Balanus* is the type.

Balanophoreæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledones*, comprising 14 genera and ab. 35 species, scattered through the tropics of both hemispheres and s. Africa.

Balanopseæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledones*, including one genus and ab. 7 species, natives of New Caledonia and tropical Australia.

Balanus. See OPERCULATA.

Balas-ruby. $MgAl_2O_4$. Pale red spinel, inferior in value as a gem to the oriental ruby; found in Ceylon.

Balbi, ADRIANO, 1782–1848. Italian geographer, resident for some years at Lisbon, and in Paris, where his chief works appeared. *Atlas Ethnographique*, 1826.

Balbi, GASPARO. Venetian trader and traveler, whose *Viaggio*, 1590, gives the first European account of India, e. of the Ganges.

Balbinus, DECIMUS CŒLIUS. Emperor with Pupienus 242.

Balbo, CESARE, 1789–1853. Historian of Italy, 1848. *Hopes of Italy*, 1843.

Balboa, VASCO NUÑEZ DE, 1475–1517. Spanish adventurer, who discovered the Pacific 1513; put to death on a charge of treason.

Baldachin. The canopy covering an altar, pulpit, or shrine. From the Italian *baldacchino*.

Bald Cypress. Large tree of the order *Coniferæ*, native in swampy districts of the s. e. U. S., yielding a valuable timber and from its roots the "cypress knees." Botanical name, *Taxodium distichum*.

Bald Eagle. *Haliaëtus leucocephalus.* Emblem of the

Bald Eagle.

Republic; N. American sea-eagle, 3 ft. long, of brown color, the head, neck, and tail white after third year. Feeds on fishes, which it frequently secures by robbing the Osprey, or Fishing Eagle.

Balder. In Norse mythology, son of Odin and Friga, mildest and wisest of the Æsir; slain by an arrow of mistletoe thrown by blind Höder at Loki's instigation. Personification of the sunlight; his death typifies the withdrawal of the sun in winter.

Baldness. Thinness or lack of hair, most common in men, due usually to senile atrophy of the hair roots, prolonged fever, presence of parasitic fungi or syphilis. That arising from the first cause is unrelievable. In the other varieties removal of the exciting causes is generally followed by a new growth of the hair. The constant wearing of headgear and too tight crimping of the hair are believed to induce baldness at an early age.

Baldwin I., 1171–1206. Count of Flanders, made emperor of Constantinople 1204 by Crusaders.—His nephew, BALDWIN II., 1217–1273, reigned 1228–61.

Baldwin, HENRY, LL.D., 1780–1844. M.C. from Pa. 1817–22; Justice U. S. Supreme Court 1830. *Constitution and Govt. U. S.*, 1837.

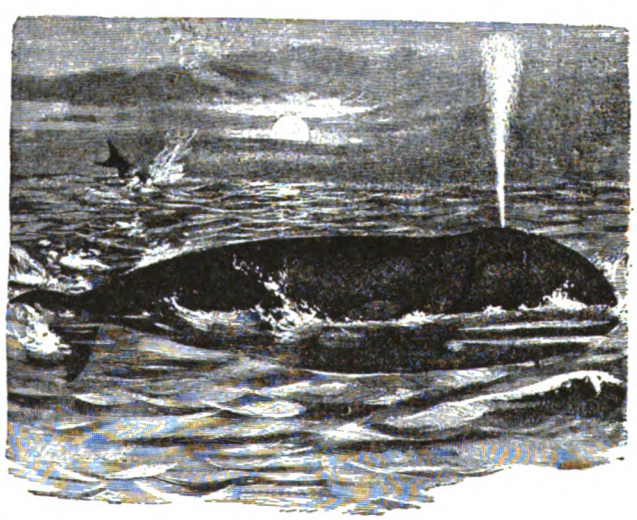
Bâle. See BASEL.

Bale, JOHN, 1495–1563. Bp. of Ossory 1552–53; Prebend of Canterbury 1558; author of 19 plays and of a Latin work on British Writers, 1548–59.

Balearic Isles. Minorca, Majorca, Iviza and Formentera, with many smaller ones, in w. Mediterranean, adjacent to Spain, to which they belong. Pop., 1887, 312,646. Majorca is the chief, and Palma the capital.

Baleen-Plates, or WHALEBONE. Flexible, horny plates that hang down from the sides of the upper jaw of Mysticete whales. They are thin strips, ab. a foot wide, and may be ten feet long at the middle part of the jaw. The inner edges and lower ends are frayed out into coarse hairs, a foot or more long. The plates serve as a strainer, holding back the small invertebrates of the sea water which the whale takes in great mouthfuls; and then on raising the tongue between the two rows of plates, and closing the spoon-shaped lower jaw, the water is pressed out and the food retained. The plates are set transversely and so close together that 300 or more are present on each side. Whalebone is now high-priced, having reached $5.00 per lb., its chief uses being for women's dresses and for whips.

Baleen-Whale. Genus *Balæna;* includes whales that



Baleen-Whale (*Balæna mysticetus*).

have long baleen plates, hence the head is very large; the vertebræ of the neck are ankylosed into a single bone. There are 14 species, of which the most important are *B. mysticetus*, the Bowhead or Greenland whale, which may attain a length of 64 ft., yielding 300 barrels of oil and nearly two tons of whalebone. The flukes of an animal only 47 ft. long were 19 ft. across, and the blowholes (nostrils) a foot long. The eyes are relatively small and placed behind the angle of the mouth. The ears are only ¼ inch across. The color is black or brown, with white beneath. The gullet is only two inches in width. This animal lives on minute invertebrates. It can stay below the surface from ten to thirty minutes, but when struck by a harpoon they have been known to stay an hour and to descend to the very bottom. It lives only where ice forms, in the

northern hemisphere. *B. sieboldii*, the Right Whale of the n. Pacific, is distinguished by a "bonnet" on the end of the upper jaw. *B. cisarctica*, the Biscay whale, is that common off the New England coast. Balænæ are warm blooded, viviparous and suckle their young.

Balestier, Wolcott, 1861–1891. American novelist, resident in London as a publisher from 1888. *The Naulahka* (with R. Kipling), 1892; *Benefits Forgot*, 1893.

Balfe, Michael William, 1808–1870. Irish operatic composer, tenor singer and manager, best known by his masterpiece, *The Bohemian Girl*, 1843. His productive period was 1835–63. He composed English operas chiefly, but set also French and Italian pieces.

Balfour, Arthur James, LL.D., F.R.S., b. 1848. Nephew of Lord Salisbury, and his sec. 1878–80; M.P. 1879, cabinet minister 1886, Irish secretary 1887. Conservative leader in the Commons since 1891; author of *Philosophic Doubt*, 1879; *Foundations of Belief*, 1895.—His brother, Francis Maitland, F.R.S., 1851–1882. *Comparative Embryology*, 1881.

Baliol, or **Balliol,** John, ab.1259–1315. Rival of Bruce, recognized by Edward I. as heir to the throne of Scotland; crowned 1292; expelled 1296.—His son, Edward, d. 1367, reigned Sept.–Dec. 1332.

Balliol College. One of the oldest at Oxford, and now the largest; founded 1282 by the widow of John de Balliol.

Balistes, or Trigger-fish. Genus of fishes of the family *Balistidæ*, e.g., *B. capriscus*. These fishes have the power to raise or lower at will the first spine of the dorsal fin. This spine cannot be pressed down unless the second spine is depressed, acting much like the hammer and trigger of a gun, whence the name Trigger-fish. Found principally in tropical waters.

Balize, or British Honduras. Colony of Central America, area 7,562 sq. m. The country is mainly low and marshy, and unhealthy for Europeans, but rises into mountains along w. border. Pop., 1891, 31,471. Balize is the capital.

Balkan Peninsula. Region s. of the Danube and Save R., including Greece, European Turkey, Servia, etc.; so called from the Balkan Mts., between Rumelia and Bulgaria; scene of many wars, and much changed by the Berlin Treaty 1878.

Balkash. Lake in s. w. Siberia, 390 m. long, receiving numerous streams, but having no outlet.

Balkis. Arab name of that queen of Sheba who visited Solomon.

Ball. One of the most ancient of games; mentioned by Homer; much used by Greeks and Romans. Balls have been found with other implements for games dating from an early period in Egypt, and ball-play is represented upon the Egyptian monuments. Games with ball are very general among savage and barbarous peoples. They are frequently of a ceremonial and divinatory character. The Tlachtli of the ancient Mexicans is rendered by the old interpreters as a representation of the motions of the heavenly bodies, and the ball court as representing the two firmaments, day and night. The term is more chiefly applied to games played with a single ball, such as base-ball, foot-ball, cricket, and the like, in distinction from those in which more than one ball is in play at the same time, as billiards and croquet. See Base-ball, Basket-ball, Foot-ball, Hand-ball, Roller-ball, Cricket, and Tennis.—Technical term in base-ball, used to describe a pitched ball which fails to pass over the home-plate and between the batsman's shoulder and his knee. Four balls so delivered entitle the batsman to a base without being put out.

Ball, Thomas, b. 1819. American sculptor; studio at Florence. Equestrian statue of *Washington*, in Boston Public Gardens; *Daniel Webster*, in Central Park, N. Y.; *Lincoln*, at Washington; colossal bronze *Washington*, at Columbian Exposition.

Ballad. Originally a dance-song, but afterward a narrative poem designed to be sung; a sort of minor epic. The term is as vague in music as in literature, and was adopted by Chopin, Liszt, Brahms, and others for short pianoforte pieces of a lyrical character. Also a narrative poem set for soli, chorus and orchestra, in the cantata style.

Ballad Operas. English, like *The Beggar's Opera*, wherein the melodies were borrowed from the popular ballads of the day.

Ballads, British. Very numerous, and of remote though unknown date and authorship. Among the best are those in the lowland Scotch dialect. Many of their themes are common to the European *Volkslieder*. They have been classified according to subjects as historical, romantic, and supernatural. Of English ballads proper the Robin Hood Series is most noted.

Ballanche, Pierre Simon, 1776–1847. French social philosopher and poet. *Social Palingenesis*, 1828; *Vision of Hébal*, 1832.

Ballantine, James, 1808–1877. Scottish poet and artist.

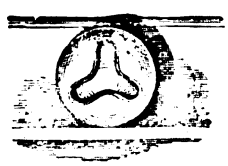
Ballantyne, Robert Michael, 1825–1894. English writer of 74 tales for boys.

Ballarat. City of Victoria, Australia, in the gold fields. Pop., 1891, 24,199; district, 46,033.

Ballast. In navigation, substances placed in the hold of a vessel to insure sufficient weight and stability; in civil engineering, broken stone, gravel, or cinders, placed around and beneath the ties of a railroad track in order to make a firm roadbed, and prevent disturbance by frost. Broken stone ballast is the best, and its cost is ab. $3,000 per mile of single track.

Ballet. Pantomimic dance, generally introduced as an intermezzo in an opera or other dramatic entertainment, traced to the Greek religious festivals, and described in Apuleius's *Golden Ass*, Book X.

Ball-flower. Ornament frequently employed in mediæval architecture as a decoration of concave moldings, consisting of a nearly hemispherical projection hollowed out into three lobes holding a central ball.



Ball-flower.

Ballista. A Roman military engine for throwing large missiles, designed on the principle of the cross-bow. The Catapult was a similar engine used for discharging arrows.

Ballistic Galvanometer. Constructed with a short needle of slow period, the object being to measure the quantity of electricity in a momentary current. This quantity is directly proportional to the size of half the angle of deflection.

Ballistic Machine. Apparatus for finding the initial or other velocity of a projectile. The *ballistic pendulum*, devised by Robins ab. 1740, was the first of these machines. The *gun pendulum* consisted of a gun suspended in the same manner as the block with the axis of the bore coincident with the line of percussion. On being fired, the extent of the arc of oscillation determined the initial velocity of the shot. From 1860 electro-ballistic machines were devised, such as Benton's and Navez's; but the Le Boulenge's chronograph has superseded them all. In principle it depends on the time of fall of a rod while a shot passes from one point to another along the range. Other ballistic machines are the Schultz Chronoscope and Sebert's Velocimeter.

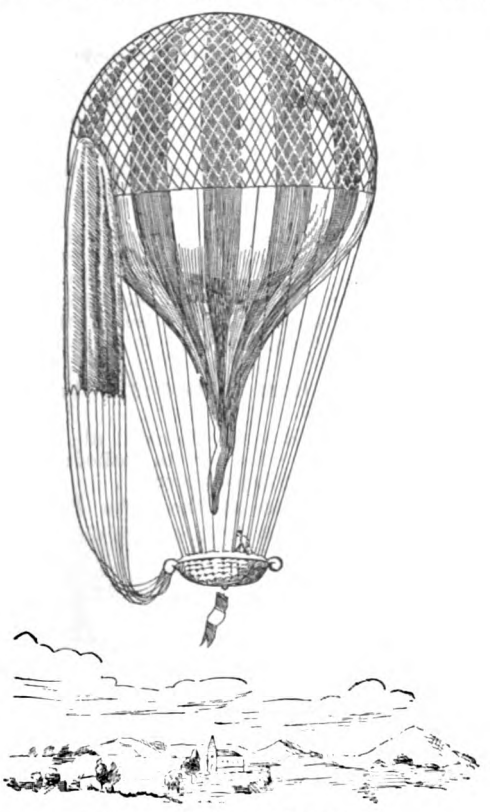
Ballistic Pendulum. Device for determining the velocity of a projectile. If a heavy penetrable mass M be suspended from a point, and a bullet of mass m, moving with a velocity v, imbed itself in M, in virtue of the energy $\frac{1}{2} m v^2$ of the bullet, the joint mass $M+m$ will be displaced from its position of equilibrium till the suspending cord is inclined at a maximum angle δ from the vertical. The energy imparted and the work done against gravity are equal, and if h be the distance from the center of suspension to the center of mass of $M+m$, we may write $\frac{1}{2} m v^2 = (M+m) g h$ vers. δ; from which by simple reduction we learn that $\sin \frac{\delta}{2} \propto v$, or the sine of half the angular deflection is proportional to the square root of the energy of the impinging bullet. The stability of a ballistic pendulum in any position is the increment of energy necessary to cause 1° more deflection. It appears from the above formula that this is greatest when δ is about 90°. When the energy imparted exceeds $2 (M+m) g h$, or when v is greater than $2 \sqrt{(M+m) \frac{g h}{m}}$, the pendulum is thrown completely round the circle. Considerations of this sort are of importance in connection with the stability of ships.

Ballistics. Branch of gunnery relating to the motion of projectiles; *interior* ballistics treats of the action of the powder gases in producing strains on the gun and in moving the projectile to the muzzle; *exterior* ballistics deals with the motion of the projectile after it leaves the muzzle. Benjamin Robins, by his invention of the ballistic pendulum and his work, *New Principles of Gunnery*, 1742, first established the science of ballistics on a substantial basis. Subsequently Rumford's experiments 1792, Hutton's with the ballistic pendulum 1805, Mordecai's researches on gunpowder 1842–45, Rodman's invention of prismatic powder and the pressure guage and his improvements in gun casting 1849–61, with the scientific investigations of Piobert, Bunsen, Schischkoff and others, caused rapid advances to be made. From 1875 to the present time the extremely valuable labors of Capt. Noble, R.A., and Sir F. Abel, on fired gunpowder in closed vessels, have so far perfected the science of interior ballistics that a working theory of practical gun construction has been deduced and practically applied.

The modern sea coast gun may justly be regarded as a complete triumph of the application of scientific principles to the control of the enormous forces developed by high explosives for war purposes. The main difficulty in the development of exterior ballistics has been the determination of the law of air resistance to bodies with varying velocities. The important labors of Bachforth 1864–79, and those of Didion, Siacci, Mayevski, Niven and others, have been fruitful in solving this problem. The two principal instruments now used for finding initial velocities of projectiles are the Schultz Chronoscope and the Le Boulengè Chronograph; the ballistic and gun pendulums and other early velocimeters being obsolete. Sebert's Velocimeter is used for finding the velocity of the recoil of the gun, from which also that of the projectile can be determined.

Ballistite. Smokeless powder, consisting principally of dinitrocellulose combined with nitroglycerine; it is formed into sheets and then cut up into strips or cubes.

Balloon. First used by the brothers Mongolfier at Annonay, France, June 5, 1783; first ascent made Nov. 21, 1783, by Pilatre de Rozier; used at the battle of Fleurus, June 17, 1794; all these were hot-air balloons. The first ascent in a hydrogen



Balloon with Car and Parachute

balloon was made by Charles, in Paris, Dec. 1, 1783. The highest elevation yet reached was by Glaischer, at Wolverhampton, Eng., 1862, about 7 miles, bar. 7 in., fall in temp. 62°. They are now employed for ships' lookouts, particularly in the French Navy. By sending up "captive" balloons from war-ships the visible horizon is considerably extended. They are also used for raising sunken vessels. See AIR SHIP.

Balloon-Ball. English game of 14th century, played with an inflated ball of strong leather, struck by the arm, which was defended by a bracer of wood.

Balloon Boiler. Early form of steam generator, usually accredited to James Smeaton, ab. 1740. Its shape was spherical on top, but flattened on the bottom, under which the fire was placed. The double curvature of the plates made them difficult to construct. From their shape sometimes also called Haystack Boiler.

Ballot. Method of voting designed to secure secrecy, as distinguished from an open or viva voce vote. The ballot was used in Athens in the 5th century B.C., and perhaps before. In Rome the people voted at first by open response, but afterward by tablets bearing the names of their candidates. In Great Britain the ballot was adopted in 1872; in Australia and other British colonies it generally prevails. In France the secret vote was employed in deliberative voting in the Chamber of Deputies, but is now confined to elections by the people; in Germany it is used in all elections for the imperial parliament. In Italy candidates for the Chamber of Deputies are elected by ballot in public halls, to which only registered or qualified voters are admitted. Spain, Belgium, Switzerland and Austria have it. In Hungary it is compulsory in the election of municipal councils, but was abolished in parliamentary elections 1874. It existed in the American colonies, and was made obligatory by the constitutions of N. J., Pa., N. C. and other States in 1776. In New York viva voce voting prevailed until 1787. Some reforms in the mode of casting a ballot have been recently adopted in many States and municipalities. The principal object of them is to secure greater secrecy and independence in voting. In many cases the voter prepares his ballot in a place apart, and in such manner that no one else knows how he votes. The two following methods with variations are in use in many of the States. The Australian system has the offices arranged alphabetically with the candidates' names and party affiliation attached, all on one ticket. The voter crosses off those names he does not wish. Another method is to group offices and names by parties, in parallel columns; a cross marked at the head of a column votes the whole column. A split ticket can be made up by crosses against selected names.

Ballou, HOSEA, 1771–1852. Chief promulgator of Universalism in America.—His nephew, HOSEA, D.D., 1796–1861, first pres. of Tufts College 1854–61, wrote *Ancient History of Universalism*, 1829.

Ballou, MATURIN MURRAY, 1820–1895. Son and biographer of HOSEA SR. *Cuba*, 1854–85; *Pearl of India*, 1894.

Ball's Bluff, VA., on the Potomac. Scene of Confederate victory, Oct. 21, 1861, over small Union force led by Col. E. D. Baker, who was killed.

Ball-Stamp. Direct acting steam stamp for crushing ore and rock, named from its inventor, and first introduced in the Lake Superior copper region in 1856.

Balm. Plant of the Mint family, *Melissa officinalis*, a native of Europe.

Balmaceda, JOSE MANUEL, 1840–1891. Pres. of Chili 1886, and would-be dictator. After many acts of tyranny he was overthrown by Congress and the navy Aug. 1891, and committed suicide Sept. 19.

Balmez, JAIME LUCIANO, D.D., 1810–1848. Spanish priest. *Protestantism and Catholicism*, 1842–44, tr. 1849.

Balm of Gilead. Gum-resin produced by *Balsamodendron opobalsamum*, of the *Burseraceæ*, native of Red Sea region; also, in N. America, a Poplar, the *Populus candicans*. Balm of Gilead Fir is *Picea balsamea*, the CANADA BALSAM (q. v.).

Balmony. *Chelone glabra*. N. American plant of natural family *Scrophulariaceæ;* also known as Turtle-head, Snake-head and Shell-flower.

Balmoral. Queen's castle in Scotland, 50 m. w. of Aberdeen; completed 1855 on a large tract bought 1852.

Balsam. Garden plant of Geranium family, *Impatiens balsamina*, native of India; known also as Ladies' Slipper. Other species of *Impatiens* also bear this name. See JEWEL WEED.

Balsam-Apple, WILD. *Micrampelis lobata*, a spiny-fruited vine of natural family *Cucurbitaceæ*, native of the e. U. S., often cultivated for ornament.

Balsam Fir. *Abies balsamea*. Large tree of natural order *Coniferæ*, family *Pinaceæ*, native of N. America; also known as Canada Balsam.

Balsam of Copaiba. Resin obtained in Brazil from species of *Copaifera*, large trees of natural family *Leguminosæ*.

Balsam of Tolu. Resin obtained from species of *Myrospermum*, large trees of natural family *Leguminosæ*, natives of Tropical America.

Balsam (*Impatiens tracornis*).

Balsam, OLD-FIELD. Species of *Eupatorium* and *Gnaphalium*, genera of Composite family, natives of e. U. S.

Balsam, WEST INDIAN. Gum-resin obtained from species of *Clusia*, trees of natural family *Guttiferæ*, burned as incense in R. C. churches in S. America.

Balsamo, THEODORUS, d. ab. 1204. Canonist at Constanti-

nople. His works are included in collections of Greek canon law.

Balter. In architecture, a wall sloping outward, whether so as to overhang a structure beneath or to support a structure above, is said to be built baltering, and the slope is called the balter.

Baltic Sea. Arm of the Atlantic extending far into the European coast and separating Russia and Germany from Sweden.

Baltimore. Chief city of Maryland, on Patapsco R., at the head of tide and navigation, 14 m. from Chesapeake Bay. It has ample communication by means of 5 railroads, and an extensive commerce by sea. It is irregularly laid out, has 290 miles of paved streets, and an excellent and ample water-supply from Gunpowder R., by gravity. The principal public park is Druid Hill, on the outskirts of the city, containing 693 acres. The sewer system is in an embryonic condition. It is the seat of Johns Hopkins University, opened 1876. Its manufactures are extensive and varied, but without distinguishing features. Pop., 1890, 434,439. B. was laid out 1729, chartered as a city 1796, and made independent of county organization 1855. The British attacked it Sept. 12, 1814. April 19, 1861, a Mass. regiment on the way to Washington was assailed in the streets by a mob, and several killed.

Baltimore, Lord, Sir George Calvert, 1582–1632. En nobled 1625. He attempted to colonize Newfoundland and visited Va. 1628.—Cecil, his son, received a charter June, 1632, and through his brother Leonard founded the colony of Maryland 1633.

Baltimore Oriole. *Icterus galbula.* Noted for its beauty and song. It builds a purse-shaped nest, pendent from branches, in which 3 to 5 whitish eggs, streaked with brown and black, are deposited. The male is marked with black on head, back,

Baltimore Oriole.

part of tail and wings; white on the tips of greater wing coverts, rich orange (sometimes lemon yellow), on lower parts, etc. Adult female is much more somber in color, resembling the young of both sexes. Length 7 in., of which the tail is 3. Habitat, e. N. America. In the Northern States it appears in May or June and is gone by Sept. It feeds on insects and cherries, and nests principally in willows and elms.

Baltimore Truss. Introduced by Balt. Bridge Co., ab. 1875; floor beams are supported in the middle of panels by vertical suspension rods attached to the main web members.

Baltzer, Richard, 1818–1887. German mathematician, Prof. Giessen. *On Determinants*, 1857–75; *Analytical Geometry*, 1882; *Elements of Mathematics*, 1885.

Baluba. Group of tribes in Central Africa, near the Sankuru River and s. of the Dwarfs. They live in clean villages, with straight streets, shaded by palms; are experts in various arts and manufactures; good-natured and peaceable, and have mild laws. They wear skins, and tattoo the body extensively. In war and hunting the lance with iron point is used, also poisoned arrows. They use razors for shaving. In some tribes both men and women smoke, drawing the smoke through a bowl of water, and inhaling it to produce intoxication. Some are polygamous. The huts are oven-shaped, and fetich worship abounds. One tribe, Quioco, is noted for its hunters and its iron industries.

Baluches. One of two races of Baluchistan; Iranians, professing Mohammedanism and practicing polygamy. They differ from the Brahoes (who are short and thick, with round and flat features and of Hindoo origin) in being tall, with elongated face and prominent features. They are pastoral and warlike, but lazy and dissipated when not engaged in predatory pursuits. Wives are procured by purchase; and a man is expected to marry his brother's widow. One of the tribes constitutes the robber hordes of s. w. Afghanistan. With the Brahoes, they number ab. 400,000, subdivided into many tribes.

Baluster. In architecture, a shaft resting on a continuous base and helping to support a continuous coping.

Balustrade. Series of balusters inclosed between pedestals; employed in nearly all styles of architecture, though most frequent in classic.

Baluze, Etienne. 1630–1718. French historian. His *House of Auvergne*, 1708, was suppressed. *Lives of the Avignon Popes*, 1693.

Balzac, Honore de, 1799–1850. Greatest of French novelists. *Eugénie Grandet*, 1833; *Le Père Goriot*, 1834; *Séraphita*, 1834; *César Birotteau*, 1837. These and many more are included in his "Human Comedy," a wonderful series, embodying the minutest and most extensive observation of life and character in Paris and the provinces. Recent translations by Miss K. P. Wormeley.

Balzac, Jean Louis Guez de, 1594–1654. French essayist. *Letters*, 1624; *Prince*, 1631.

Bamberg. City of Bavaria, founded ab. 770, ruled by prince-bishops 1007–1802; noted for its cathedral, built 1004, restored 1828–37, and for its export-beer.

Bamboo. Large grasses of the tribe *Bambusaceæ*, of

Bamboo.

which more than 100 species are known; natives of tropical regions.

Bamian. Ancient Buddhist settlement in Afghanistan. Carved out of the rock at the side of the valley are five gigantic statues, the largest ab. 178 ft. high, supposed to represent Buddhist deities.

Bampton Lectures. "Eight divinity lecture-sermons," delivered annually since 1779 at St. Mary's, Oxford; founded by the will of John Bampton, 1689–1751, canon of Salisbury. The series includes many valuable contributions to religious knowledge and thought.

Ban. Feudal barons of France, when summoned to military service by the king. Their tenants or vassals were the Arrière Ban.

Ban. Governors of banats or districts in e. Hungary.

Ban, MATIJA, b. 1818. Servian poet and dramatist; Minister of Foreign Affairs 1860; pensioned 1868. *Mejrima*, 1851.

Banana. *Musa sapientium.* Large plant of natural family *Musaceæ*, a native probably of India; cultivated from prehistoric times in tropical countries for its edible fruit.

Bancroft, GEORGE, LL.D., D.C.L., 1800–1891. U.S. minister to England 1846–49, and to Berlin 1867–74. His *History of the United States* appeared in 12 vols., 1834–82, in a revised edition, 6 vols., 1885, and is a monument of research.

Bancroft, HUBERT HOWE, b. 1832. American historian. His series, beginning with *Native Races of the Pacific States*, 1875, includes Central America, Mexico, California, Oregon, and the adjacent regions, and extends to 39 large vols.

Bancroft, RICHARD, D.D., 1544–1610. Bp. of London 1597, Abp. of Canterbury 1605. He anticipated Laud's High Church measures, and was a severe opponent of Puritanism.

Band. Part of distinctive scholastic, legal, or ecclesiastical dress; relic of the ancient amice worn round the neck and shoulders.—In music, a company of instrumental performers, dating from the earliest times. See illust. ASSYRIAN ART.

Band. In architecture, a projecting member unmolded, and rectangular in profile. In the Middle Ages, the member called "Baguette" in French, a projecting and molded course attaching separate shafts to a central pillar or to the wall or pier. Banded shafts are of especially frequent occurrence in English Gothic.

Bandages. Appliances usually consisting of strips of cotton, linen or woolen fabric used for supporting or compressing a part, or maintaining applications in position. When thoroughly impregnated with plaster, starch, shellac, soluble glass, or some body which after a time becomes firm and immovable, they are used in the treatment of fractures, spinal disease, etc., and have almost entirely supplanted the clumsy splints formerly in use. Those of rubber, silk or woolen are employed in sprains, varicose veins, and other conditions where continuous gentle pressure is desired, and to expel the blood from limbs, etc., preparatory to surgical operations upon them. Too long continued or too tight bandaging often causes the death of the part to which they are applied.

Bandello, MATTEO, 1480–ab.1561. Italian author, Bp. of Agen 1550. His *Novelle*, 3 vols., 1554, ranked next after Boccaccio's.

Bandettini, TERESA, 1755–1837. Italian poet and dramatist.

Bandicoot. (1) Species of insectivorous marsupials, Australia. (2) A rodent, Pig-rat or Great Bandicoot of India, 20 in. long.

Bandilore. Toy introduced into Europe from India in 18th century. It consists of two discs joined by an axle, around which a string is wound. The player holds one end of the string and allows the bandilore to fall, giving the string a quick jerk before it has completely unwound, and thus causing it to rewind.

Bandinelli, BACCIO, 1493–1560. Florentine sculptor. Represents the decline of taste which followed the successes of Michaelangelo. The group of *Hercules and Cacus*, on the Piazza della Signoria at Florence, shows the weakness and defects of his style. His best works are the low-relief figures on the marble choir-screen of the Florence Cathedral.

Band-Saw. Endless steel band having saw teeth formed on one edge, passing over two wheels on parallel axes. The lower one is driven, and turns the upper by means of the tension of the saw. The tension is maintained by means of a weight or spring, or both, acting upon the journals of the upper wheel. By using a very narrow band of steel, such a saw can cut out curves of sharp curvature, and can operate much faster than a JIG SAW (q.v.), as the action of the teeth is continuous. Special devices have to be used to receive the thrust of the cut back of the blade at the working point. Very thin gauges of steel may be used for band-saws, which adapt them for resawing valuable woods so as to cause the least loss in dust and "karf." The saw is made endless by the use of a scarf-joint, brazed. See RESAW and SAW.

Bandy-Ball. Old English game played with sticks called bandies, bent and round at one end, and a small wooden ball which each party endeavors to drive to opposite fixed points.

Baneberry. *Actæa spicata* and *A. alba.* Herbs of the Buttercup family, natives of n. hemisphere.

Bang, ANTON CHRISTIAN, b. 1840. Norwegian Ch. historian.

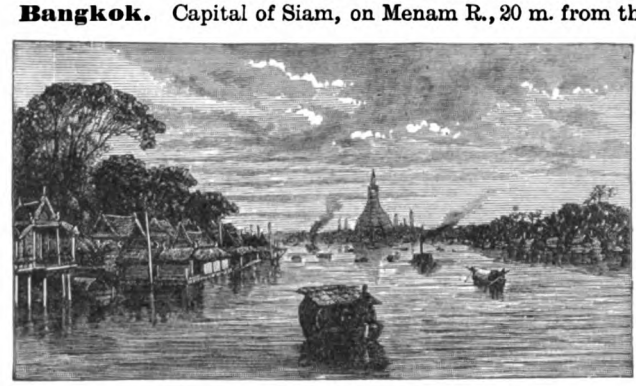
Bang, HERMAN, b. 1857. Danish novelist.

Bangala. Tribe of w. coast of Central Africa. They paint their bodies carmine color. Their huts are saddle-shaped, 7 ft. high and 13 by 26, with three rooms. King receives a part of all that is gained in hunting. Selection of a new king is accompanied by symbolic rites. The magicians are all-powerful and are judges. Witchcraft is rampant among them. The uncle on the maternal side has control of the children, sells the girls to husbands, and if the wife dies receives damages from the widower.

Bangalore. Capital of Mysore in s. India, 200 m. w. of Madras, 3,000 ft. ab. tide; stormed by British 1791, occupied 1831. Pop., 1891, 179,670.

Bangiaceæ. Small order of red marine *algæ.*

Bangkok. Capital of Siam, on Menam R., 20 m. from the



Bangkok.

sea. The population is said to number 700,000, including a large European element, who have introduced considerable western civilization.

Bangor. Ancient See city of N. Wales, on Menai Strait. Pop. ab. 10,000.

Bangor. City of Maine, on Penobscot R., 30 m. from its mouth, at the head of tide and navigation. It is irregularly laid out, and has large commerce in and manufactures of lumber. Pop., 1890, 19,103.

Bangor Theological Seminary. Chartered by Mass. 1814; opened at Hampden, Me., 1816; removed to Bangor 1819; controlled by Congregationalists. It has 5 professors, ab. 40 students, and a library of 18,000 vols.

Bangs, JOHN KENDRICK. American humorist. *Coffee and Repartee*, 1893, *Three Weeks in Politics*, 1894; *Water Ghost*, 1894.

Bangs, NATHAN, D.D., 1778–1862. American divine; ed. *Christian Advocate* 1828, pres. Wesleyan Univ. 1841–42. *Hist. M. E. Church*, 4 vols., 1839–42.

Bangweolo. Lake in central Africa, on the headwaters of the Lualaba or Congo.

Banim, JOHN, 1798–1842. Irish novelist and dramatist. *O'Hara Family*, 1825–26; *Croppy*, 1828; *Ghost-Hunter; Mayor of Wind-Gap.*

Banishment. Under the Roman Empire, of several kinds. *Exsilium* deprived a man of the rights of a Roman citizen, and by the symbolic deprivation of fire and water he was forbidden to live within the limits assigned by his sentence. *Religatio* was a lesser penalty whereby citizenship and property were not lost, but the person had to live where the judges or the emperor decreed. *Deportatio* was accompanied by loss of these rights, and the condemned person was confined to a particular island or town.

Banjo. Rude musical instrument much affected by negroes in America, consisting of a hoop covered with a tightly-drawn membrane, a neck and finger-board without frets, a head and keys for tuning, and strings which vary in number, one of which, the shortest, called the chanterelle, is on the bass side and twanged with the thumb. It is probably of African origin, and developed from the "bania" of Senegambia or the "bandora."

Bank. Institution for receiving and lending money. Those of the U. S. may be classified as National and State banks, savings banks, private banks, loan and trust companies. A State bank is the creation of the State in which it is located. Though the State laws regulating their formation differ in many regards, in general they prescribe a fixed amount of capital, the election of five or more directors, the lending of only a fixed amount to any individual or corporation, the reservation of a fixed amount of the earnings as a surplus fund, and the making of returns to a State officer concerning resources, liabilities and general operations. They were formerly authorized to issue notes.

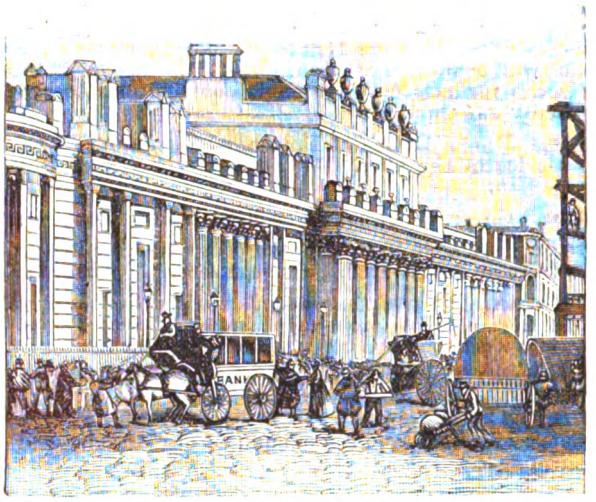
In 1863 the national bank system was organized, one object being to create a demand for the bonds of the Government, as these formed their capital and basis of note issues. At first, the aggregate amount of capital that could be invested in national banks was limited. In 1875 this restriction was removed, and since then individuals have been free to organize as many banks as they please on the terms prescribed by law. See SAVINGS BANKS. The first bank in the U. S. was that of N. America, Phila., chartered by Congress Dec. 31, 1781, and by Pa., April 1, 1782; opened for business Jan. 2, 1782. The Mass. bank was incorporated Feb. 7, 1794; that of N. Y., March 21, 1791, though doing business from 1784. Hamilton's plan for a Bank of the U. S. was approved by Washington Feb. 25, 1791. It was chartered for 20 years, with a capital of $10,000,000; rechartered for 20 years April 16, 1816; capital $35,000,000. New York Clearing House established Oct. 1853; that in Boston March 1856.

Bank Holiday. In Great Britain, a secular day on which banks are closed and parties to negotiable paper are exempted from the obligation of presentment, payment, etc. In the U. S. within a few years bank holidays have been established, in many States part of, or, during the summer, all of Saturday.

Banking, ORIGIN OF. This business is ancient, and was denounced Exod. xxii.25. That of borrowing money by issuing promissory notes payable to bearer, which passed as money in the bank's sphere of operations, is a secondary department. Banks for discount are said to have been in operation in China 2600 B.C. Banks of deposit early existed in Greece and Rome; they received and lent money, exchanged foreign moneys, and negotiated bills of exchange, but did not issue notes. The earliest bank in Christendom was that of Venice, 1171–1797, based upon a forced loan of the Republic. Deposits were transferable on the books, but could not be withdrawn. Modern banking seems to have originated in Florence in the 13th century. The Bank of Barcelona, 1401, first negotiated foreign bills of exchange. That of Genoa first issued circulating notes. These banks were simply governmental fiscal agents. The Bank of Amsterdam, 1607, was the first for the promotion of commerce. The Bank of England is a fiscal agent and also devoted to the service of commerce. The Bank of France, 1800, has the exclusive privilege in Paris since 1803, and France since 1857, of issuing notes payable on demand.

Bank-Note. Obligation issued, payable on demand, by a bank, for general circulation as money. Most of the systems of State-bank-note issues were defective, resulting in great losses to their holders. The first sound system was established by New York, and was adopted in the national bank system. The capital of national banks, or a portion of it, must be invested in U. S. bonds, which are deposited with the U. S. Treasurer. They can issue notes to the amount of 90 per cent of the face value of the bonds. To secure their circulation, a tax of 10 per cent was imposed on the issues of the State banks, which had the designed effect of extinguishing them. The system of issuing notes by the Bank of England is very different. The issue is divided into two parts. One part is called a fixed issue, and is based on the deposit of consols and other obligations held by the bank. The amount prescribed by the act of 1844 that could thus be issued was £15,000,000. The other part is a varying issue, and is based solely on specie held by the bank. At the time of establishing this system it was supposed that the paper circulation in Gt. Britain was somewhat excessive, and so the law provided that the Bank of England could increase its fixed issue by two-thirds of the amount of the circulation of any bank which failed.

Bank of England. Projected by William Paterson, a Scotch merchant, to raise funds for William III.'s war against France; charter granted July 27, 1694, and frequently renewed; subject to amendment; issue department established 1844.



Bank of England.

Bankruptcy. Status of a debtor who has been subjected to statutory proceedings for the distribution of his property ratably among his creditors, and for discharge from his debts. The U. S. Congress is empowered to establish uniform bankruptcy laws. In the absence of national legislation, a State may enact a bankruptcy statute; but this can discharge the debtor only from debts due to its own citizens and to persons who voluntarily become parties to the proceedings.

Bankruptcy, NATIONAL. Failure of a government to meet its financial liabilities; whether in the form of repudiation of the public debt, of defaulting in the payment of interest, or of refusal to redeem paper money or debased coin in money equally good with what was originally loaned.

Banks, SIR JOSEPH, LL.D., 1743–1820. English naturalist who sailed round the world with Cook 1768–71; pres. Royal Society from 1778; baronet 1781; chief founder of the colony of Botany Bay. He introduced useful plants into West Indies; bequeathed his collections to the British Museum.

Banks, NATHANIEL PRENTISS, LL.D., 1816–1894. M.C. 1852; speaker of the House 1856; gov. of Mass. 1857–60; major-general of volunteers 1861–64, operating in Va. and in the Gulf; M.C. 1865–73, 1875–79, and 1889–91.

Banksia. A tree or shrub of the *Proteaceæ* family, named in honor of Sir Joseph Banks; popularly known in Australia as honeysuckle trees. One species attains a height of 50 ft.

Banks Land. Large island of N. America, in Arctic Ocean.

Bannockburn, SCOTLAND. Scene of the defeat, June 24, 1314, of Edward II. of England, who with an army of 100,000 attacked Robert Bruce and his 30,000; 50,000 English were slain or made prisoners. Near B. James III. of Scotland was defeated and slain by his nobles June 11, 1488.

Bans. Proclamation in church of approaching marriage. The names are announced to enable valid objections to be made. Published in English Church after second lesson, in Roman Catholic during public Mass, on three successive Sundays or festivals. Customary in the early church; made canon law 1200; confirmed by Council of Trent 1545; confined to Roman Catholics in U. S.

Banshee. Domestic spirit or fairy, believed by the Scotch and Irish peasantry to intimate approaching disaster by wailings and mournful songs.

Bantingism. System for the reduction of obesity, named from Wm. Banting (1797–1878), who pub. a pamphlet 1863, giving a dietary by means of which he reduced his flesh without unpleasant results. It consists in the avoidance of fat, starch, and sugar as far as possible, a method as old as Hippocrates, and practiced to a considerable extent until it was found to cause great discomfort and in some cases Bright's Disease. Modern methods for reduction of flesh allow sufficient of the above bodies to supply the natural waste, and depend more upon exercise and proper habits of life.

Bantu. Negro hordes of central Africa, s. of Sudan. Those in the east are more specifically known as Kafirs.

Banville, THEODORE FAULLAIN DE, 1823–1891. French poet, dramatist, and novelist. *Cariatides*, 1842; *Stalactites*, 1846;

Odes funambulesques, 1857; *Souvenirs*, 1882. His play, *Gringoire*, has been adapted in England.

Banyan. Large tree of the Fig family, *Ficus Bengalensis*, native of India, remarkable for its abundance of aërial roots

Banyan Tree.

which, drooping from the branches, enter the soil and become secondary trunks, the tree thus covering an immense area.

Baobab. *Adansonia digitata*. Large tree of the Mallow family, native of w. Africa, with an immensely thick trunk.

Baour-Lormian, PIERRE MARIE FRANCOIS LOUIS, 1770–1854. French dramatist of the classic school, Academician 1815; tr. Tasso 1795, and Ossian 1801.

Bap ki ("Little women"). Popular game of Russian children, played with the phalangal bones of a cow or ox, which are stood on end in line and shot at with other bones; resembling marbles.

Baptanodon. American genus of great fossil reptiles, related to Ichthyosaurus, but without teeth.

Baptism. Sacrament admitting into the Church; confined by Baptists to adults; administered with varying fullness, from trine immersion to slight aspersion.

Baptism, HERETICAL. Long objected to, but later acknowledged as valid, when administered in water and in the name of Father, Son, and Holy Ghost.

Baptism, LAY. Usually held valid, but disapproved except in danger of death.

Baptistery. Originally a bathing-place, then the tank, containing water, for baptism; later, the place assigned for baptism, whether a part of the church or a separate building. In Italy the practice of constructing separate baptisteries was especially common. They are usually octagonal or circular in plan, and in the most famous examples, as at Florence and Pisa, richly decorated.

Baptistery at Pisa.

Baptists. Congregational Protestants, mostly Anglo-Saxon, and chiefly Calvinists, who deny the validity of all baptism not administered by immersion on profession of personal faith. American Baptist communicants in several denominations (excluding Disciples and Christians), number some 3,700,000, English over 300,000.

Bar. (1) Partition separating the officers of a court of justice from others. (2) Those members of the legal profession entitled to a place within the bar—in Britain, solicitors, Queen's counsel and barristers; in the U. S., all duly admitted attorneys-at-law. (3) The court, as in the phrase "case at bar."

Bar. Deposit of detritus across the mouth of a river, caused by the sudden checking of the velocity of its current.—In California, a shallow place in a stream, where an accumulation of sand or a rocky ridge forms a natural riffle for collecting gold.

Bar, CONFEDERATION OF. Formed 1768 by Polish nobles; suppressed 1775.

Baraga, FRIEDRICH, 1797–1868. R. C. Bp. of Sault St. Marie 1857; missionary to the Ojibway Indians, and author of a Grammar and Dictionary of their language, 1851–53.

Barak. Leader, with Deborah, of Israel's hosts in the defeat of Sisera. Judges iv.–v.

Barante, PIERRE AIMABLE PROSPER BRUGIERE DE, 1782–1866. French historian and official. *Dukes of Burgundy*, 13 vols., 1826; *Hist. National Convention*, 6 vols., 1853.

Barataria Bay. On the shore of Louisiana; once the headquarters of Lafith and other pirates, who helped in defending New Orleans and were pardoned 1815.

Baratieri, ORESTE, b. 1841. Italian gov. of Eritrea, e. Africa, victor at Kassala July 17, 1894, and at Adi Sadi Dec. 1894; lieut-gen. 1895.

Baratynski, JEWGENIZ ABRAMOVICH, 1800–1844. Russian lyric poet.

Barbadoes. Easternmost of W. India Is., lat. 13° 4′ n., long. 59° 37′ w.; area 166 sq. m.; colonized by Gt. Britain 1625. Pop., 1891, 182,322.

Barbadoes Leg. Form of elephantiasis; a disease occurring chiefly in the tropics.

Barbara, ST. Martyr of Nicomedia ab. 236, or of Heliopolis ab. 306. Her aid is invoked in storms. Her day is Dec. 4.

Barbara.

Barbarelli. See GIORGIONE.

Barbarossa (RED BEARD). 1. See FREDERIC I. 2. Horuk, ab. 1473–1518, pirate of the Mediterranean; first Turkish ruler of Algiers. 3. His brother HAIRED-DIN, d. 1546, ruler of Algiers, and of Tunis 1532–35.

Barbaroux, CHARLES JEAN MARIE, 1767–1794. French Girondist, who opposed Robespierre and was guillotined.

Barbary. N. Africa from Egypt to the Atlantic Ocean. After the Punic wars, n. Africa became subject to Rome. The Vandals, under Genseric, overran the country 429, but were defeated by Belisarius. The Greek-Roman territory was now limited to Carthage and portions of the coast. An first of a series ending in the subjugation invasion of Arabs from Egypt, 647, was the of all n. Africa, and forcible conversion of most of the native tribes to Mohammedanism. Many changes of dynasty followed; independent states arose. The crusades led to the expedition of St. Louis against Tunis, and finally to the expulsion of the Moors from Spain to Africa, whence they harassed the Christian world with their piracies. Various attempts were made by Spain and Portugal to check their ravages, which were punished by the U. S. 1801–05. Several of the states meantime submitted to the Sultan. Since 1830 Algiers is subject to France; in 1881 Tunis also. Tripoli is subject to Turkey. See TUNIS, TRIPOLI, and MOROCCO.

Barbary Ape. See CYNOPITHECIDÆ.

Barbauld, MRS. ANNA LETITIA (AIKIN), 1743–1825. English poet, best known by her hymns and writings for the young.

Barbecue. Any large animal roasted whole; also an open-air feast where carcasses are cooked entire.

Barbel. Vermiform process attached to the snout of certain fishes, probably serving as an organ of touch.

Barbé-Marbois, FRANCOIS, MARQUIS DE, 1745–1837. French official who conducted the sale of Louisiana to the U. S. 1803, and wrote its history 1828, tr. 1830. *Memoirs*, 1835.

Barber. In Canada and Nova Scotia, a gale of wind with damp snow or sleet that freezes.

Barber, JOHN WARNER, 1798–1885. Author of histories of New Haven, Conn., Mass., N. J., Va. and Ohio, 1831–47.

Barberini Palace. At Rome, containing a collection

of pictures, among which are Raphael's *Fornarina* and Guido's *Beatrice Cenci*.

Barberry. *Berberis vulgaris.* Shrub of the family *Berberidaceæ*, a native of Europe. Other species of the genus bear the same name.

Barberry (*Berberis vulgaris*).

Barbers. Known among the Jews (Ezek. v. 1) and Greeks; introduced at Rome ab.300 B.C. In the later Middle Ages they were also surgeons.

Barber's Itch. Disease of skin, found oftenest in region covered by the beard, but sometimes in other parts provided with coarse hairs, due to the presence of a fungus, the *Trichophyton parasitica*, and communicated from one person to another by contact or barbers' implements, etc. It occurs as red scaly patches or nodules, which sometimes ulcerate, the vitality of the hairs being affected in both forms, and is only curable by measures which entirely destroy the fungus.

Barbette. Mound of earth raised against a parapet to enable one or more guns to fire over it; usually located in the salient of a bastion and connected with the terre-plain by a ramp of easy declivity for the passage of guns.

Barbette-Ship. One in which the primary battery is mounted in barbettes, the guns being so mounted as to fire over the parapet. While freeboard is gained by this type, the shape of protection is not so advantageous as that of the turret form. The guns being carried higher is a marked advantage.

Barbey d'Aurevilly, JULES AMEDEE, 1808–1889. French novelist.

Barb Fence. Formed of horizontal wires attached to posts, the wires being provided with barbs to prevent cattle from tearing it down. It was introduced ab. 1870, and now is one of the cheapest forms of fence.

Barbican. Semi-circular outwork for the defense of the drawbridge in a mediæval castle.

Barbicells (or **cilia**). Frayed out, or hooked, processes borne on the sides of the anterior barbules, on the barbs of the vane of a feather.

Barbier, AUGUSTE, 1805–1882. French satirical poet, Academician 1869. *Iambes*, 1831.

Barbier, PAUL JULES, b. 1825. French dramatist.

Barbieri. See GUERCINO.

Barbour, JOHN, ab. 1320–1396. Scottish poet, author of *The Bruce.*

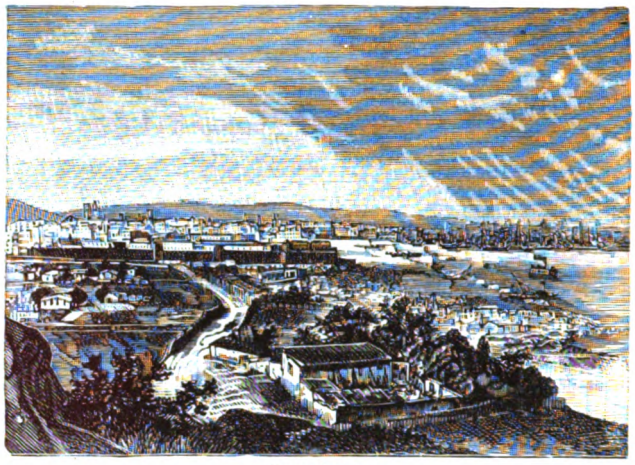
Barbs, or RAMI. Main laminæ that form the vane of a feather.

Barbules, or RADII. Little processes on each side of a barba to which they hold a relation similar to that of the barbs to the shaft of a feather.

Barca. African province of Turkish empire, e. of Tripoli, habitable only near the Mediterranean; the ancient Cyrenaica. Pop. ab. 300,000.

Barcarole. Venetian gondola or boat song, generally in the minor mode and undulating 6–8 time; also an artistic imitation of this. Celebrated specimens are found in *Zampa*, *La Muette de Portici*, and *Fra Diavolo.*

Barcelona. City and seaport of Spain, on the Mediterranean. It is the industrial and commercial center of e. Spain, and is equally important educationally, possessing a university, an academy of science, and schools of medicine and surgery. It was founded ab. 400 B.C., colonized from Carthage, taken by



Barcelona.

the Romans 146 B.C., by the Moors ab. 714, united to Aragon 1151, taken by the French 1697 and 1714, by the English 1706, and held by Napoleon 1808–14. Pop., 1887, 272,481.

Barclay, ALEXANDER. ab.1475–1552. British satirical poet; translator of S. Brant's *Ship of Fools*, 1508.

Barclay, JOHN, 1582–1621. English poet and satirist, b. in Lorraine, and writing in Latin. *Argenis*, 1621.

Barclay, ROBERT, 1648–1690. Scottish apologist of Quakerism. *Catechism*, 1673; *Apology for the True Christian Divinity* (Latin), 1676, tr. 1678; *Vindication*, 1679.

Barclay de Tolly, MICHAEL ANDREAS, PRINCE, 1761–1818. Russian general of Scottish descent, prominent in the wars against Napoleon; minister of war 1810, field-marshal 1814.

Barcocheba, SIMON, d. 135. Leader of a Jewish insurrection in Palestine under Hadrian, 132.

Bardesanes, 155–223. Syrian Gnostic, author of 150 hymns.

Bards. Poets of Celtic peoples, as the Welsh and Irish. In Wales they formed an organized society with hereditary privileges; were exempt from taxes and military duty; held song-festivals, and sang the victories of the nation and the praises of God.

Barebones, PRAISE-GOD, 1596–1679. Leather merchant of London, member of the Parliament convened by Cromwell 1653, and derisively named after him.

Bareilly. City of British India, on left bank of the Jua. It has considerable trade and varied manufactures. Pop., 1891, 121,870.

Barentz, WILLEM, d. 1597. Dutch mariner, who discovered Nova Zembla July 4, 1594, and wintered there 1596–97, the first time a polar winter had been faced by Europeans. The next spring the party crossed to Lapland in boats, B. dying on the way.

Barère de Vienzac, BERTRAND, 1755–1841. French terrorist and regicide, banished 1815–30.

Baretti, GIUSEPPI, 1719–1789. Italian, living in England from 1751; author of letters of travel, 1762, tr. 1770. His Italian dictionary and grammar were long used.

Barff's Process. Proposed to prevent iron from rusting. The iron is introduced into a bath of steam at a temperature of 650°, when it becomes covered with a firmly-adhering layer of oxide.

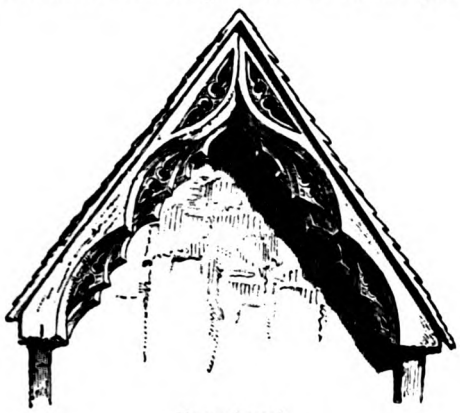
Barfleur. Town of n. France, where William of Normandy organized the fleet by which he conquered England 1066; razed by the English 1346. The French navy was destroyed off the cape by Admiral Russell after the victory of La Hogue, May 19, 1692.

Bargain and Sale. Conveyance of land introduced by the Statute of Uses (27 Hen. VIII. c. 10), to escape from the common law requirement of livery of sesin, *i. e.*, the delivery of a material symbol, as a clod or twig, by vender to purchaser. A contract for the sale of land for a pecuniary consideration

vested the use of the property in the purchaser, and the statute declared the usee to be the legal owner.

Barge. Boat, often flat-bottomed, richly fitted up for pleasure or pageantry, a house-boat is one variety; also a freight-boat and a boat for the use of officers on a man-of-war.

Barge-board, or VERGE-BOARD. Board used to cover the edge of the gable-end of a roof. In Gothic timber architecture, a decorative feature consisting of a carved board depending from



Barge-board.

the projecting roof of a gable. The earliest examples known of its use are of the fourteenth century, and it continued to be employed throughout the fifteenth, sixteenth and seventeenth centuries in the domestic architecture of France and England.

Bargello. Mediæval palace of the chief magistrate at Florence, now a National Museum.

Bargiel, WOLDEMAR, b. 1828. German musical composer, step-brother of Clara Schumann.

Barham, RICHARD HARRIS, 1788–1845. English poet and humorist. *My Cousin Nicholas*, 1834. His *Ingoldsby Legends*, 3 v., 1840–47, are notable for wit and ingenious rhymes.

Bari. Ancient city of Italy, on the Adriatic. It has a large commerce. Pop. ab. 64,000.

Baric Wind-rose. Diagram showing for any locality the average pressure of the barometer during the prevalence of wind from each point of the compass.

Barilla. Impure sodium carbonate obtained from the ashes of *Salsola soda*, a plant formerly grown in Europe.

Barilla de Cobre. Copper barilla; a deposit of native copper in sandstone, found in Bolivia.

Baring, SIR FRANCIS, 1740–1810. Founder of the London Banking House; father of Lord Ashburton.

Baring-Gould, SABINE, b. 1834. English novelist and historical writer. *Curious Myths of the Middle Ages*, 1868; *Origin and Development of Religious Belief*, 1870; *Lives of the Saints*, 15 vols., 1872–77; *Tragedy of the Cæsars*, 1892.

Bar Iron. Wrought iron rolled round or square in sizes varying from $\frac{1}{8}$ in. to 3 in. in diameter or thickness. A bar 1 sq. inch in section and 1 yard long weighs 10 lbs.

Barite. $BaSO_4$. Soft mineral, usually white, frequently occurring in large tabular rhombic crystals, and also in uncrystalline masses. Composition, barium sulphate. Sp. gr. 4.5. Known also as barytes or baryta, and, in England, as cawk. It is common with deposits of lead or silver ore. A brown stalactitic variety takes a handsome polish, resembling dark-colored marble. Bologna stone, from which Bologna phosphorus was prepared, was barite that became phosphorescent after heating with charcoal. Barite finds an extensive commercial use, chiefly as an adulterant of, or substitute for, white lead in pigments. In the U. S. the estimated yield is 28,000 tons annually, chiefly from Mo. and Va. Considerable quantities are imported from Germany. It is freed from iron by hydrochloric acid.

Barium. Ba. At. wt. 137.43; Sp. gr. 3.6. Discovered by Davy 1808, who decomposed the fused chloride by the electric current. It can also be prepared by treating a hot saturated solution of the chloride with sodium amalgam; the sodium replaces the barium, which forms an alloy with the mercury. This is decomposed by heating in a current of hydrogen. Barium occurs in nature as sulphate and carbonate. These serve as the starting-point for preparation of other compounds. It is a bright yellow metal, which fuses at a red heat, but does not vaporize; it decomposes water energetically at ordinary temperatures.

Barium Carbonate. $BaCO_3$. Found in nature as Witherite. It is made pure by adding ammonium carbonate and a little ammonia to a solution of barium chloride; the precipitate is then washed carefully by decantation. The carbonate usually found in the market is made by precipitating a solution of the crude sulphide with sodium carbonate, or by heating sodium carbonate with heavy spar. Made in either of these ways, it always contains impurities. It is used in analytical operations and for the preparation of other salts. It is poisonous, as are other salts of barium except the sulphate. It is used for sizing cotton warps and as rat poison.

Barium Chloride. $BaCl_2 2H_2O$. Made by treating barium carbonate with hydrochloric acid. It is soluble in water.

Barium Dioxide, or BARIUM PEROXIDE. BaO_2. White powder, made by heating barium oxide in the air to a dull red heat. If the dioxide be heated to bright red heat it is decomposed into the oxide and oxygen. It is used for the preparation of HYDROGEN DIOXIDE (q.v.).

Barium Hydroxide. $Ba(OH)_2$. Made by dissolving barium oxide in water. The solution has an alkaline reaction and is similar in its properties to lime water. It is sometimes called baryta water.

Barium Nitrate. $Ba(NO_3)_2$. Made by treating barium carbonate with nitric acid. It is readily soluble in water. It is a constituent of green fireworks.

Barium Oxide, or BARYTA. BaO. Made by heating the nitrate. It is used in the preparation of oxygen. See BARIUM DIOXIDE.

Barium Peroxide. See BARIUM DIOXIDE.

Barium Sulphate. $BaSO_4$. It occurs in nature as HEAVY SPAR or BARITE (q.v.). It is made by adding a soluble sulphate or sulphuric acid to a solution of a barium salt, and is used as a pigment under the name of Permanent White. It is insoluble in water and acids, but when freshly precipitated is dissolved by concentrated sulphuric acid.

Barium Sulphide. BaS. Made by heating the sulphate with carbon. It is phosphorescent.

Bark. Outer layers of the stem of exogenous plants.

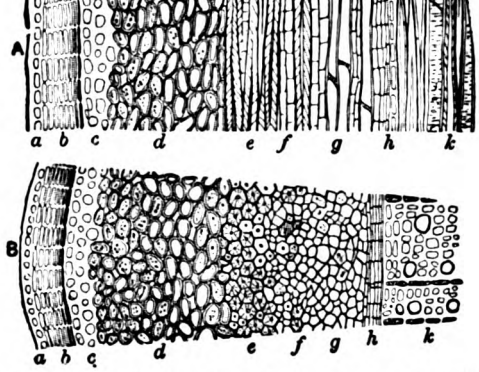


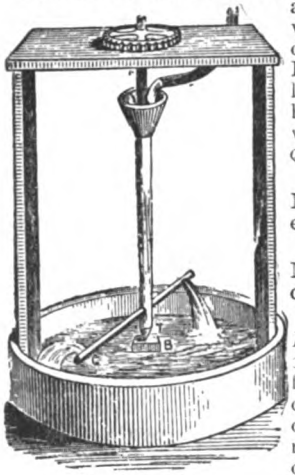
Fig. 1.—A, Longitudinal section of bark of Dicotyledon (Alder):
a, epidermis with cuticle; *b*, cork cells; *c*, thickened cells; *d*, green cellular layer of loosely placed cells containing chlorophyll; *e*, hard bast fibers; *f*, thin-walled cells of soft bast; *g*, vessels with sieve-plates of soft bast; *h*, cambium; *k*, wood with fibers and dotted vessels.
B, The same in transverse section.

Fig. 2.—Stem of Laburnum, showing the layers of the bark:
a, layer of cork cells; *b*, green cellular layer; *cc*, bast fibers with soft bast cells and cambium on the inner surface; *d*, woody cylinder transversed by medullary rays, cambium cells on its outer surface.

Barker, FORDYCE, M.D., LL.D., 1818–1891. Prof. N. Y. Medical College 1850–57, and Bellevue Hospital Coll. from 1860; pres. N.Y. Academy of Medicine 1882.

Barker, GEORGE FREDERIC, M.D., b. 1835. Chemist and electrician, prof. Yale 1867, and Univ. Pa. since 1873.

Barker's Mill. Hollow shaft having hollow radiating arms, and turned by the reaction of water escaping through them; often called the reaction water-wheel. Its efficiency as a motor is low unless the speed be very high, and hence it is rarely used as a water-wheel. See HYDRAULIC TOURNIQUET.



Barker's Mill.

Barksdale, WILLIAM, 1821–63. M. C. from Miss. 1853–61. Confederate general, killed at Gettysburg.

Barlaam and Josaphat. Mediæval romance of Buddhist origin.

Barley. Cereal grass of genus *Hordeum*, native of the Old World, cultivated from remotest antiquity for the well-known grain. The seed contains ab. 62 per cent of starch, 10 of saccharine bodies, 11 of albuminoids, and 17 of water, salts, and oil. It is employed largely in the preparation of malt, but not much as a food except when deprived of its hull [pearl barley]. A decoction in water forms a mild, unirritating drink which has been used in fevers since the times of Hippocrates. It thrives best in a deep, rich, well-cultivated soil, moist, but not too wet. It is sown in the early spring, as soon as the land can be brought into good condition, either broadcast or in drills. It is harvested by machinery, and the greatest care is taken to keep the grain from being wet, even by dew, after it has ripened, as such wetting stains the grain and results in an inferior quality of malt. It is an important part of the food supply of several of the European countries, but is very little used as such in the U. S. The grain makes an excellent food for farm animals, and the straw is of some value for the same purpose. A very large part of all the barley, except that grown in California, is malted. In California the crop is cut while the plant is still green and cured for hay. 78,331,492 bushels were raised in the U. S. in 1890.

Barlow, FRANCIS CHANNING, b. 1834. General of U. S. Vols. 1862–65; lawyer in N. Y.

Barlow, JANE. Irish author. *Irish Idylls*, 1892; *Bogland Studies*, 1893; *Kerrigan's Quality*, 1894.

Barlow, JOEL, 1754–1812. American poet; minister to France 1811. *Hasty Pudding*, 1793; *Vision of Columbus*, 1787, enlarged as *The Columbiad*, 1807.

Barlow, PETER, 1776–1862. English mathematician, author of *Theory of Numbers*, 1811; *New Math. and Philos. Dict.*, 1814; *Essay on Magnetic Attraction*, 1820.

Barlow, WILLIAM HENRY, F.R.S., b. 1812. English civil engineer; designer of the St. Pancreas Station and of the new Tay bridge; pres. Inst. of Civil Engineers, 1880.

Barmecides. Persian family associated with rise of Abasside Califs in Khorasan; one of them, Khaled, was prime minister of Almansur, and tutor of Haroun Al Raschid, who extirpated the race ab. 802.

Barmecides' Feast. Mock banquet, served in empty plates and glasses with fine names, as narrated in *Arabian Nights*.

Barmen. Town of Rhenish Prussia, 17 m. e. of Dusseldorf; noted for its extensive ribbon factories and mission-house. Pop., 1890, 116,248.

Barnabas. Cyprian Levite, orig. Joses, or Joseph, associate and supporter of St. Paul in his early apostolic labors. The epistle ascribed to him was probably written ab. 115.

Barnabites. Order founded at Milan 1530, formerly numerous in s. Europe, now confined to ab. 20 houses in Italy and Austria.

Barnaby, SIR NATHANIEL, b. 1829. An eminent naval architect; authority and writer on naval construction; was chief constructor of the British Admiralty.

Barnacle Goose. In the *Philosophical Transactions of 1677*, Sir Robert Moray pub. a *Relation concerning Barnacles*, in which he accepts as true a myth current in previous centuries, that on the n. coast of Scotland grow trees whose fruit is barnacles (*Lepas*), out of which come geese (*Anser bernicla*). The myth was supposed by Max Muller to have risen from confounding the names of these two very distantly related animals; but the appearance of the feathery feet of the barnacles and their sessile stems was doubtless mainly responsible for it.

Barnacle Goose.

Barnacles. See CIRRIPEDIA.

Barnado Homes. For homeless children; founded by Thomas J. Barnado, F.R.C.S.E. 10,000 had been reclaimed in 1887.

Barnard, LADY ANNE, 1750–1825. Author of the Scotch ballad, *Auld Robin Gray*.

Barnard, EDWARD EMERSON, b. 1857. In charge of astronomical observatory at Vanderbilt University. Discoverer of a number of comets and nebulæ.

Barnard, FREDERICK AUGUSTUS PORTER, D.D., LL.D., D.C.L., 1809–1889. Prof. Univ. Ala. 1837–54, Univ. Miss. 1854–61; pres. Columbia Col. 1864–88; ed. *Johnson's Encyclopædia*, 1874–77.—His brother, JOHN GROSS, U.S.A., LL.D., 1815–1882, was chief engineer of the Union armies 1862–65, and brevet major-general 1864.

Barnard, HENRY, LL.D., b. 1811. Pres. Univ. Wis. 1856–59. *Normal Schools*, 1851; *Library of Schools and Education*, 1886.

Barnave, ANTOINE PIERRE JOSEPH MARIE, 1761–1793. French orator, active in the Revolution till 1791; guillotined as a monarchist.

Barn-Burners. Portion of the Democratic party which in 1848 united with the Free-soil of the Whigs and nominated Van Buren for President.

Barnby, SIR JOSEPH, b. 1838. English conductor and composer of music, knighted 1892; ed. *Hymnary*, 1872. *Rebekah*, an oratorio, is his principal work.

Barnes, ALBERT, 1798–1870. Pastor in Phila. 1830–67. His trial for heresy led to the severance of New from Old School Presbyterians in 1837. His *Notes on the New Testament*, 1832 and later, were long popular.

Barnes, JAMES, ab. 1809–1869. Brigadier-General in the late war. Chief engineer of the Seaboard & Roanoke R. R. Constructed wholly or in part the Buffalo, Corning & New York, the Terre Haute, Alton & St. Louis R. Rs., etc., between 1848 and 1857.

Barnes, WILLIAM, 1801–1886. English poet, who wrote in the Dorsetshire dialect.

Barnet, ENGLAND. Site of Edward IV.'s victory, April 14, 1471, over the Lancastrians, of whom Warwick and 7,000 men were slain.

Barnett, JOHN, 1802–1890. English musician. His first musical dramatic work was produced in 1825. *The Omnipresence of the Deity*, 1829; *Mountain Sylph*, 1834; *Fair Rosamond*, 1836; *Farinelli*, 1838.

Barnett, JOHN FRANCIS, b. 1837. Composer of vocal and instrumental music. His works are: *The Raising of Lazarus*, 1873; *Paradise and the Peri*, 1870; *Harvest Festival*, 1881, etc. He completed the orchestration of Schubert's unfinished symphony.

Barneveldt, JAN VAN OLDEN, 1547–1619. Grand Pensionary of Holland. He bore a main part in securing the independence of the Netherlands 1609, but was unjustly convicted of treason and beheaded through influence of the Synod of Dort and of Maurice of Orange.

Barnfield, RICHARD, 1574–1627. English poet.

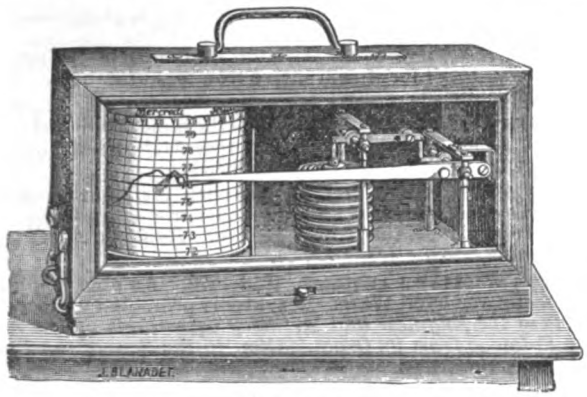
Barnum, PHINEAS TAYLOR, 1810–1891. American showman. *Autobiography*, 1854; *Humbugs*, 1865.

Barnyard-grass. *Panicum Crus-galli*. Coarse grass, native of the Old World, widely diffused as a weed.

Baroccio, FEDERIGO, 1528–1612. Florentine painter. Leading artist of the decadence. His style was based on Correggio, but vapid and overstrained.

Baroda. City of British India, capital of the Gaikwar's dominions, near Bistwamintre R. Pop., 1891, 116,460.

Barograph, or BAROMETROGRAPH. Instrument which automatically records the barometric pressure and its variations over an extended period.



Barograph.

Barometer. Instrument for measuring the pressure of the atmosphere. In its simplest form it consists of a glass tube ab. 80 centimeters long, closed at one end, filled with mercury and inverted in a cistern of mercury. If the liquid in the tube stands at a height of h centimeters above the surface in the cistern, the pressure of the atmosphere is $f\,g\,h$ dynes per sq. centimeter, in which f is the density of the mercury, and g is the force of gravity. The normal height is ab. 76 centimeters or 30 inches, and the pressure is commonly given in centimeters or inches. Liquids lighter than mercury are sometimes used, but in this case the tube must be much longer. In accurate work several corrections are necessary to apply to the observed reading to obtain the true reading. See ANEROID.

Barometer.

Barometric Depression. See BAROMETRIC MINIMUM.

Barometric Elevation. See BAROMETRIC MAXIMUM.

Barometric Gradient. See GRADIENT.

Barometric Maximum. 1. Area on the weather map within which barometric pressure at any time is decidedly above the average or normal value for that time and place. 2. Area in which the normal barometric pressure is decidedly above the normal prevailing in other regions.

Barometric Minimum. Reverse of the above.

Barometric Rate. Rapidity with which the pressure rises or falls within a standard unit of time, usually one hour.

Barometric Surge. Term applied by Abercromby, 1887, to certain oscillations of the barometer occurring simultaneously over large areas, such as the whole of India, and traveling from the west eastward; almost synonymous with Barometric Wave.

Barometric Trough. Term applied by Birt, 1840, to the low barometer between two high waves; from a fancied resemblance between barometric fluctuations and ocean waves.

Barometric Wave. Term applied by Birt and Herschel, 1840, to the successive rise and fall of the barometer, observed by them in Europe and by Espy in America to move consecutively like ocean waves eastward over all stations.

Barometrograph. See BAROGRAPH.

Barometz, or DICKSONIA BAROMETZ. Fern, native of China, on which the fable of the Scythian Lamb is based.

Baron. Oldest and lowest order of British nobility.

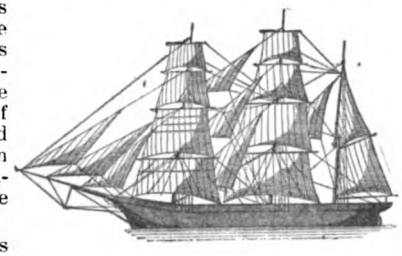
Baron, or **Boyron,** MICHAEL, 1653–1729. French actor and dramatist.

Baronet. Hereditary order, instituted 1611 for Great Britain and Ireland; confined practically to England since 1801.

Baronius, CESARE, 1538–1607. Cardinal 1596. As the Pope's confessor he is said to have procured the absolution of Henry IV. by refusing the Pope absolution until he granted it. His *Ecclesiastical Annals till 1198*, 12 vols., 1588–1607, have been continued by others, and are of high importance.

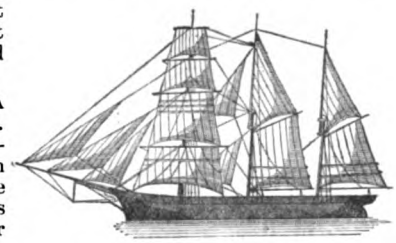
Baroque Style. That of the later Renaissance, 17th and 18th centuries. Its traits show an extravagant and overloaded system of decoration, whose details are Renaissance, but treated in more broken and arbitrary lines than those of the 16th and 15th centuries. The word is from the Portuguese *barocco*, meaning a rough pearl, and was originally a jewelers' term. The word Rococco is also applied to the more extravagant phases of the late Renaissance.

Baroscope. Instrument devised by Hooke, 1715, to show the density or buoyancy of the air. One of its forms is a balance, the beam of which supports two spheres of very unequal size, which balance each other in the air. If the apparatus be placed under the receiver of an air-pump and the air exhausted, the larger sphere will weigh the most.



Barque, or BARK. Is the name given to vessels having the same rig as a ship except mizzen-topsail, or having only fore-and-aft sails on the mizzen mast. Barques sometimes have four masts.

Barquentine, or BARKENTINE. Is fitted with three masts, square-rigged with yards on the foremast only, and fore-and-aft sails on the main and mizzen masts.



Barr, MRS. AMELIA EDITH (HUDDLESTON), b. 1831. Novelist of English birth, resident in Texas 1854–69, and since in N. Y. She writes largely on historical or Scottish subjects. *Jan Vedder's Wife*, 1885; *A Daughter of Fife*, 1886; *Friend Olivia*, 1891; *Beads of Tasmer*, 1891.

Barrackpur. Suburb of Calcutta and military station, 15 m. up the Hooghly R. The Sepoy revolt of 1857 began here. Pop., 1891, 57,330.

Barracks. Buildings for the accommodation of troops; a term also applied to crowded tenements. The U. S. possess 163 barracks.

Barracks, DEFENSIVE. In the German or Polygonal system of fortification, the barracks for troops are arranged for defense against the field and siege guns of the besiegers by strong masonry walls, with earthen face covers; they are also often bomb-proofed to withstand the vertical fire of bombs. Illustrations are found in the fortifications constructed by Colonel Brialmont for the defense of Antwerp.

Barrande, JOACHIM, 1799–1883. French geologist. His reports on his survey of Bohemia, 1846, established the existence there of Devonian and Silurian formations and of rocks now considered older, characterized by a distinct fauna. These, believing them to contain the first evidences of life on the earth, he named "Primordial Zone"; they are now usually called Cambrian.

Barrantes y Moreno, VICENTE, b. 1829. Spanish author and politician. *Juan de Padilla*, 1855.

Barras, PAUL JEAN FRANÇOIS NICOLAS, 1755–1829. French revolutionist, active in the south and in the destruction of Robespierre; in the Directory 1795, and twice in chief power; overthrown 1799 by Napoleon, whom he had brought to the front, and in exile till 1814.

Barratry. The offense of frequently stirring up law-suits to the disturbance of the peace; a common-law misdemeanor punishable by fine and imprisonment. Also any fraud of mariners to owners' injury.

Barre, ISAAC, 1726–1802. Irish officer, M.P. 1761, prominent advocate of American independence.

Barrel. Cylindrical vessel bulging in the center. Also quantity which it contains: apples 11 pks; beer 31½ gals.; cement, hydraulic, 300 lbs.; flour 196 lbs.; lime 280 lbs.; petroleum 40 gals.; pork and beef and salt fish 200 lbs.; rosin 280 lbs.; sugar 320 lbs.; whisky 42 gals.; flour barrel holds 3 struck bu.

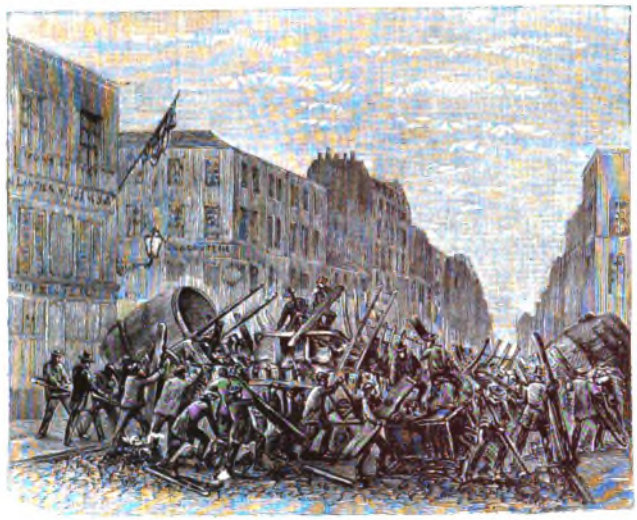
Barrel Organ. Familiar instrument of street musicians producing tunes automatically, a revolving crank turning a cylinder armed with pegs, which play upon valves and admit wind to small pipes from a bellows simultaneously kept in motion.

Barrett, GEORGE HOOKER, 1794–1860. Anglo-American comedian.

Barrett, LAWRENCE, 1838–1891. American actor, eminent in tragic parts. His career began 1853. *Life of E. Forrest*, 1881.

Barrett, WILSON, b. 1846. English actor, author in part of *Hoodman Blind*, 1885; *Clito*, 1886, and other plays.

Barricades. Obstacles and defensive works raised in the streets of Paris against Henry III. by the League 1588; by the



Barricade during Commune, Paris, 1871.

popular party in the Revolution of July, 1830; again in June, 1848; and in the spring of 1871 by the Communists.

Barrie, JAMES MATTHEW, b. 1860. Scottish novelist. *Auld Licht Idylls*, 1888; *A Window in Thrums*, 1889; *The Little Minister*, 1891.

Barrier Reef. Coral reef of considerable extent, lying at a distance from the shore. It leaves a deep channel between it and the mainland; the outer slope is precipitous, and the depth many times greater than in the channel. The reef is broken in places by passages. Sometimes such a reef encircles a submerged mountain, and thus forms an atoll. The great reef off the n. e. coast of Australia is over 1,200 m. long, and at an average distance of 25 m. from land, the channel being ab. 100 ft. deep, while the sea outside is 2,000 ft. deep.

Barrier Treaty. Nov. 15, 1715, at Antwerp, permitting the Dutch to maintain garrisons in the Austrian Netherlands. Other treaties respecting the barrier-towns of the Dutch were signed 1709 and 1713, the latter at Utrecht.

Barrière, JEAN FRANÇOIS. 1786–1868. French editor of many vols. of Memoirs relative to the Revolution and the 18th century.

Barrière, THEODORE, 1823–1877. French dramatist.

Barrington, SIR JONAH, 1760–1834. Irish judge. *Personal Sketches of his Own Time*, 3 vols., 1827–32.

Barrios, JUSTO RUFINO, 1835–1885. Pres. of Guatemala 1873; killed in an attempt to force a union of Central American states.

Barrister. A lawyer admitted to plead to the bar; in England the rank is conferred only by one of the Inns of Court. In the U. S. there is no such class; an attorney may perform the duties of an advocate or barrister.

Barron, JAMES, 1769–1851. American naval officer. Commander of the *Chesapeake* in her encounter with the British ship *Leopard* in time of peace, 1807; killed Com. Decatur in a duel 1820.

Barros, JEAN DE, 1496–1570. Portuguese historian and official. His *Asia Portugueza*, 1552–63, was continued by D. de Couto.

Barrow. Mound marking and covering an interment, commonly used in the burials of prehistoric Europe, as well as of other countries. They are found containing interior-chambered apartments, built of large blocks of stone, and also as simple earth mounds. The latter are the later ones in Europe and belong to the Bronze Age. The chambered barrows are either oblong or circular, some of the former reaching a length of 300 ft.

Barrow, MRS. FRANCES ELIZABETH, 1822–1894. American writer ("Aunt Fanny") of children's books.

Barrow, ISAAC, D.D., 1630–1677. English mathematician and divine; prof. Cambridge 1660–69. *Lectiones Opticæ et Geometricæ*, 1669–70. His chief works, *Sermons* and *A Treatise of the Pope's Supremacy*, were posthumous.

Barrow, SIR JOHN, F.R.S., 1764–1848. English author of books of travel, and of lives of Lord Howe, Anson, and Drake; chief founder of the Geographical Society 1830. *Southern Africa*, 1801–04; *China*, 1804; *Polar Regions*, 1818.

Barrow-in-Furness. Borough of Lancashire, England, on Irish Sea, noted for its extensive iron manufactures. Pop., 1891, 51,712.

Barrow, POINT. In Alaska. Northernmost point of mainland of N. America, projecting into the Arctic; location of a temporary station of U. S. Signal Service.

Barry, JOHN WOLFE, b. 1836. English civil engineer, specially associated with the London underground railroads and the construction of the Tower Bridge. *Railway Appliances; Railway and Locomotive*, 1882.

Barry, WILLIAM FARQUHAR, 1818–1879. An able soldier in the Mexican and Civil Wars. Repeatedly promoted for bravery. *Reports of the Engineer and Artillery Operations of the Army of the Potomac from its Organization to the close of the Peninsular Campaign*, 1863.

Bart, JEAN, 1651–1702. French seaman, active against the English and the Dutch; made by Louis XIV. commander of a squadron.

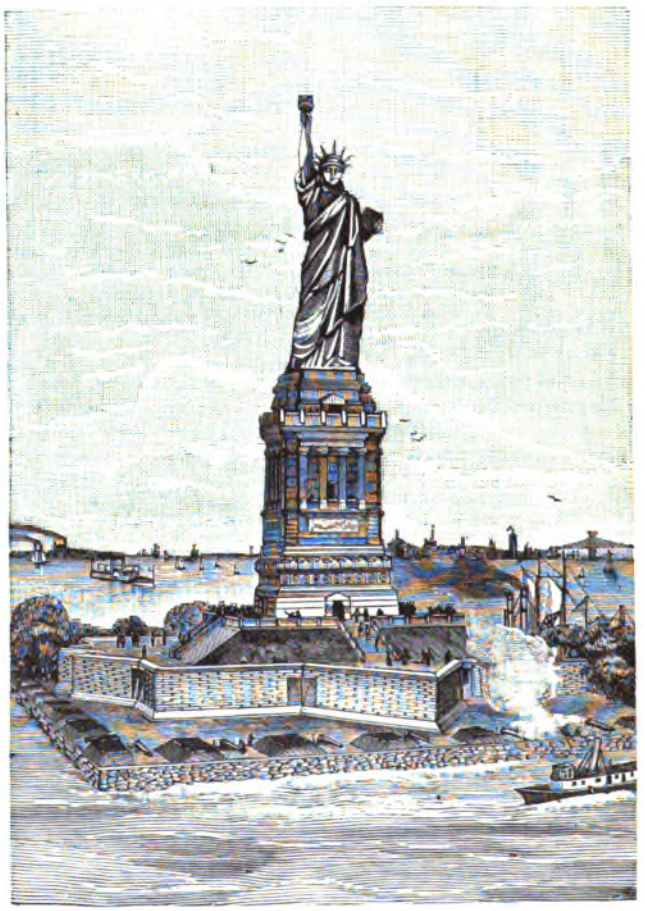
Barter. Form of exchange in which commodities useful in themselves are given for others without employing money.

Barth, HEINRICH, 1821–1866. German traveler; prof. Univ. Berlin 1863. His *Discoveries in Central Africa*, 5 vols., 1858, grew from researches made 1850–55.

Barthelemy, JEAN JACQUES, 1716–1795. French author and numismatist; Academician 1789. *Travels of Anacharsis in Greece*, 4 vols., 1788.

Barthélemy Saint-Hilaire, JULES, b. 1805. French essayist, official, and translator of Aristotle. *Buddhism*, 1855.

Bartholdi, FREDERIC AUGUSTE, b. 1834. French sculptor. Best known work, *Liberty Enlightening the World*, colossal



Statue of Liberty.

statue on Bedloe's Island, N. Y. Harbor, presented to the U. S. by the French people and unveiled in 1886. It is made of sheet copper. His statue of *Gen. Lafayette* is in Union Square, New York.

Bartholomew. One of the 12 Apostles, probably Nathanael.

Bartholomew Fair. Market held in London Aug. 24; chartered 1133; abolished 1855.

Bartholomew, St., Massacre of. Slaughter of French Protestants, which began in Paris Aug. 24, 1572, extended to the provinces. No deed in modern history has been more notorious, or exerted wider and more lasting influence.

Bartimæus. Blind beggar at the gates of Jericho, who obtained from Jesus restoration of his sight.

Bartizan. A fortified turret projecting from the angle at the top of a tower. A word coined by Scott.

Bartlett, John. b. 1820. American compiler. *Familiar Quotations*, 1854; *Concordance to Shakespeare*, 1894.

Bartlett, Josiah, M.D., 1729–1795. Signer of the Declaration of Independence; M.C. 1776-78; pres. N. Hampshire 1790; gov. 1793.

Bartol, Cyrus Augustus, D.D., b. 1813. Unitarian pastor in Boston 1837–87. *Radical Problems*, 1872.

Bartoli, Adolfo, b. 1833. Prof. at Florence 1874. *History of Italian Literature*, 7 vols., 1878–89.

Bartolini, Lorenzo, 1777–1850. Italian sculptor.

Bartolommeo, Fra (B. Pagholo del Fattorino), 1475–1517. Florentine painter of the great period. Through him, largely, the methods and discoveries in painting of Leonardo da Vinci passed to the contemporaries of the Florentine School, especially Raphael. Friend of Savonarola, under whose influence he for a time abandoned art, becoming a monk. His works are mainly altar-pieces. Best painting, *The Deposition*, in the Pitti Gallery.

Bartolozzi, Francisco, 1728–1815. Florentine engraver, long resident in England, and from 1805 at Lisbon. He excelled in the engraving of nude and semi-nude figures, and worked in the dotted or stipple manner. Most of his plates were printed in brown or red inks.

Barton, Benjamin Smith, M.D., 1766–1815. Prof. Col. Phila. and Univ. Pa. from 1789. *Botany*, 1803; *Materia Medica*, 1810.—His nephew, William Paul Critton, M.D., 1786–1856, prof. Univ. Pa. 1815, pub. 6 vols. of *Florœ*, 1815–23, and *Materia Medica*, 1817–18.

Barton, Bernard, 1784–1849. English "Quaker Poet." His verses are largely devotional.

Barton, Clara, b. ab. 1830. Army nurse 1861–65; founder (1881), pres., and historian of the American Red Cross Society.

Barton, Elizabeth ("Maid of Kent"), 1506–1534. Impostor, whose visions and prophecies as to Henry VIII. and his divorce deluded many; executed after confession.

Barton's Buttons. Made by John Barton in England, by pressing upon the flat polished top of an ordinary brass button a steel die having a number of small squares ruled with fine lines crossing each other. Owing to the phenomena of interference produced by these ruled surfaces, the light reflected from them is brilliantly colored.

Barton's Cubes. Made ab. 1810 to illustrate the force of cohesion. If a dozen were piled one above the other, the whole could be held suspended by supporting the top one only.

Bartram, John. 1699-1777. Founder, 1728, of the Botanic Garden near Phila.—His son William, 1739–1823, carried on his work, started Alex. Wilson, the ornithologist, on his career, and pub. *Travels*, 1791, containing the best list of American birds to that date.

Bartsch, Karl Friedrich Adolf Konrad, 1832–1888. German philologist; prof. at Rostock 1858–71, and Heidelberg 1871–88; editor of *Germania* from 1869; translator of Dante and the Nibelungenlied. His works relate to mediæval literature, chiefly in France and Germany.

Bartûansky, or Bortuiansky, Dimitri, 1752–1825. Composer of church music; called the Russian Palestrina.

Baruch, Book of. Apocryphal appendix to Jeremiah, containing admonitions and consolations ascribed to that prophet and his disciple Baruch; received as canonical by Roman and Greek Churches, but rejected by Protestants.

Bary, Heinrich Anton, b. 1831. Botanist; prof. at Freiburg, Halle, and Strassburg.

Barye, Antoine Louis, 1795–1875. French sculptor. Famed especially for designs of animals, in which he has no modern equal. His peculiar forte is large and bold rendering of the essentials of form without reference to minute and literal details. See his *Life and Works*, by C. De Kay, 1890.

Baryta. See Barium Oxide.

Baryta Water. See Barium Hydroxide.

Barytocalcite. $(BaCa)CO_3$. Barium and calcium carbonate, crystallizing in the monoclinic system.

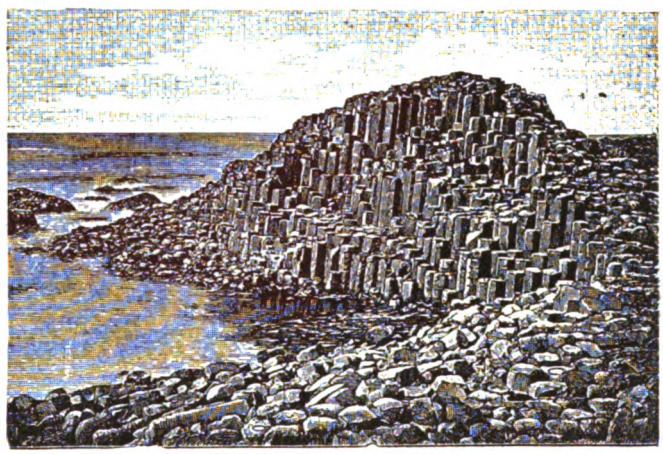
Barytone. In music, male voice between bass and tenor in quality and range; also a small bass saxhorn.

Basal Cells. Areas in basal part of web of wings of *Diptera*, inclosed by the longitudinal ribs or veins from second to sixth.

Basalia. Cartilages at base of pectoral fins of fishes, to which the radialia of the rays are attached. They are the propterygium, mesopterygium, and metapterygium. Also the basal plates of Crinoids.

Basal Plates of Crinoids. Surrounding point of attachment of stem and intervening before the radials which begin the series that make up the arms. Also called basalia.

Basalt. Dark-colored, compact, crystalline rock of igneous origin, consisting essentially of labradorite and augite, though small quantities of chrysolite or other minerals are often present as accessories. It occurs as the typical basic eruptive rock in many parts of the earth, and frequently takes the form of regular, jointed columns, as at the "Giants' Causeway," on n.



The Honeycomb, Giants' Causeway.

coast of Ireland, where it forms a series of massive steps projecting into the sea, and at Fingal's Cave in Staffa, near the opposite coast of Scotland. Both of these are relics of a once continuous sheet of basalt poured out upon the top of the chalk. The Palisades of the Hudson are another example of the same formation. By decomposition basalt produces a variety of alteration products, known by special names. Dolerite is a coarse-grained rock of the same mineralogical composition. Compare Trachyte.

Basanite. SiO_2. Fine-grained, black, siliceous mineral, also called Lydian stone; used by the ancients for testing the purity of gold and silver by the color of the mark left by these metals when rubbed upon the stone.

Bascom, Henry Bidleman, D.D., LL.D., 1796–1850. Pres. Transylvania Univ. 1842; Bp. M. E. Ch. South 1850.

Bascom, John, LL.D., b. 1827. Prof. Williams College 1855; pres. Univ. Wisconsin 1874–87. *Political Economy*, 1859; *Æsthetics*, 1862; *Sociology*, 1887.

Base. In architecture, the lowest member of a pier, column or wall. In the case of detached supports, as piers or columns, the base is commonly expanded, so as to give a visibly sufficient footing to the shaft, and the bases of columns are commonly square in plan. The transition from the square plinth to the round shaft is softened by an intermediate member and by base-moldings.—In the Doric order, the columns have no separate bases, but stand directly on the pavement. In Gothic architecture, the space between the square plinth and the rounded base of the shaft are often filled out with carved ornaments, called griffes. In mediæval architecture, the practice was introduced of supplying projecting bases for continuous supports, or walls, as well as for detached supports, and these were often of considerable richness and elaboration.

Base. Compound of a metal with oxygen and hydrogen. These compounds have the power of neutralizing acids, forming salts and water. $Ba(OH)_2+H_2SO_4=BaSO_4+2H_2O$.

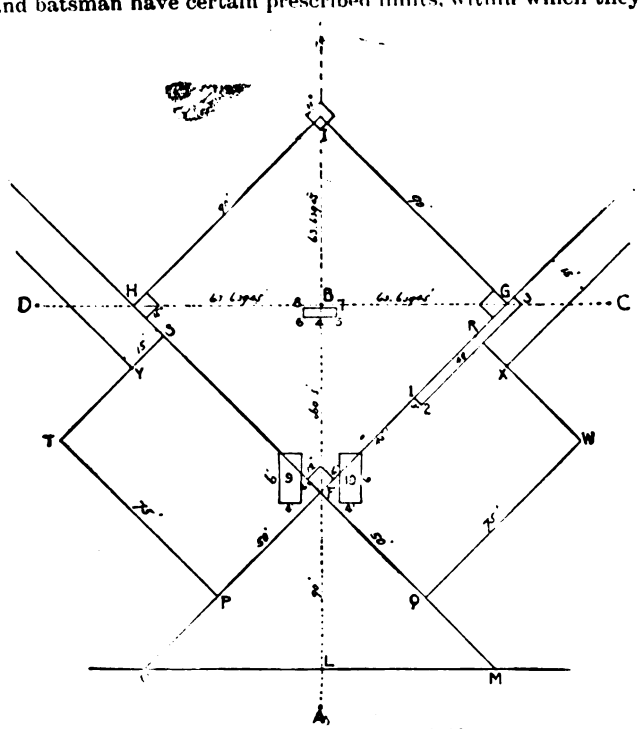
Base. In a geometric figure, the side or face on which the figure is supposed to stand.

Base of a System of Logarithms. Constants, the exponents of which are the logarithms of the numbers embraced in the system.

Base of a System of Numbers. Unit of the first order.

Base-Ball. The national game of U. S. Its origin was undoubtedly the same as that of cricket, rounders, and other games played with a bat or mallet and a round ball. The Knickerbocker Club of N. Y. was the first organized, 1845. It

became of general interest in the U. S. ab. 1860, and after the war was again taken up energetically. Excepting a year or two, when the public was antagonized by a rupture among the players, it has steadily increased in popular favor. It is played by two teams of nine men each, one side taking its turn at the bat, while the other occupies the field. One of the latter, the pitcher, must deliver the ball to the opponents for them to hit. The field should be at least 300 ft. long and nearly as broad, level, and preferably covered with turf, though this is not essential. Upon the field is laid out a diamond. Its nearest corner, marked by a square plate and called the home base, should be 90 ft. from the end of the field, and the sides should be 90 ft. long. The three other corners are marked by canvas bags, and are called, beginning at the right as one stands upon the home plate and looks down the field, first, second, and third bases. The lines from home to first and home to third indefinitely prolonged are called the foul lines. The two sides toss for choice, and the members of the one which goes to the bat take turns in regular order in hitting, or attempting to hit, the ball, until three of them have been put out. Those in the field arrange themselves as follows: the infielders, called in order first baseman, second baseman, shortstop, and third baseman, in a half circle just behind the lines connecting the bases; then behind them in a second semi-circular formation, ab. 30 yards further out, the outfielders, right, center, and left. The two remaining players, the pitcher and catcher, take up their positions nearer the batsman, who always stands at the home plate, the former in a place marked out for him some 55 ft. in front of the home plate, and the latter behind that plate, wherever he thinks best to catch the ball. Both the pitcher and batsman have certain prescribed limits, within which they



Correct Diagram of a Ball Field.

must stand, the former when delivering the ball and the latter when endeavoring to hit it. The members of the side in the field endeavor under certain rules to accomplish the putting out of the side at the bat, and when they have put out three they in turn become batsmen. The game consists of nine turns at the bat by each side, called nine even innings. The men of the batting side who are actively engaged in the play are the batsman and base-runners. The batsman becomes a base-runner under the following conditions: as soon as he has made a fair hit, *i.e.*, knocked the ball so that it will fall in front of the foul lines, or when he has had three strikes or fair opportunities of hitting the ball, or when the pitcher has delivered "four balls," *i.e.*, pitched the ball four times without its being struck at by the batsman or passing over the plate at the proper height. In this last event he is entitled to first base without being put out, but in the other cases he takes his chances against his antagonists, who endeavor to put him out. He is safe only when on one of the bases, and these he must touch in regular order, first, second, third, and home. If he does this without being put out, he scores a run for his side, and the total number of runs scored in nine innings decides the match. A batsman is put out if he hits the ball and it is caught by an opponent before touching the ground. A base-runner may be put out as follows: if, having made a fair hit, the ball be caught before touching the ground, or be held by any opponent who is at the same time touching first base before the runner reaches that base; or if, after three strikes, the ball be held before touching the ground, or, having touched the ground, be held on first base as above mentioned, or if at any time he be touched by the ball in the hands of a fielder, when the base-runner is not touching the base to which he is properly entitled. One or two umpires are employed to settle all disputes, and call balls and strikes.

Base-Ball Arm. Loss of strength, pain and tenderness, followed by inflammation of the bone of the upper arm, observed in base-ball players; due to excessive or long-continued pitching. Taken in its early stages, it is relievable by rest and massage, but when the bone becomes involved the usefulness of the limb is impaired.

Basedow, JOHANN BERNARD, 1723–1790. German pedagogist. His scheme for educational reform was set forth in an *Elementary*, 4 vols., 1774.

Basedow's Disease. Exophthalmic goitre.

Basel. Ancient city of Switzerland on the Rhine; rebuilt 917, and of great importance in the Middle Ages and during the Reformation. It has a cathedral, erected 1010–19; a university, founded 1459, with a large library; museums, and some manufactures. Pop., 1888, 73,749.

Basel, COUNCIL OF, 1431–1449. Called by decree of the Council of Constance to adjust the Bohemian schism; attended by the Hussites 1433; attempted reforms, was deserted by most of its members, and in 1439 deposed Pope Eugenius IV. and elected Felix V., making a new schism. Its last ten years were inglorious, and it had no sessions between 1443 and 1449.

Basel, TREATY OF. (1) April 5, 1795. Prussia surrendered her lands w. of the Rhine. (2) Between France and Spain, July 1795.

Base-Level. Term recently introduced in geology to express the condition of the land where, by long-continued erosion, the rivers have accomplished its degradation to water-level. Such a condition must ultimately arrive everywhere if the agencies of destruction act long enough. To this process are now attributed the wide, nearly horizontal planes of erosion denominated pene-plains, once ascribed to marine denudation. These on subsequent elevation are again attacked by the erosive agents and dissected, reducing the pene-plain, as a first stage in its destruction, to a complex of valleys with intervening ridges whose tops rise approximately to a uniform level, as in the Appalachian system.

Base-Line. In geodesy, a line measured with great care, to serve as the foundation of a system of triangles for connecting distant points. Generally the measurements are made with metallic rods; the correction of these for change of temperature is a source of much uncertainty, to avoid which bars have been employed on the work of the U. S. Coast Survey compensated for temperature. The principle is the same as that of the grid-iron pendulum; probably the most perfect form of apparatus hitherto devised is the "reed bar" used by R. S. Woodward of the Coast Survey on the base-line at Hilton, Indiana, 1891. While in use the bars are packed in ice, and thereby all uncertainty of correction for temperature avoided. Good results for secondary bases are obtained with long wires or tapes of steel, stretched to a constant tension by using a spring balance, and the temperature carefully noted.

Base Metals. The ordinary metals, excepting gold, silver, quicksilver, platinum, and a few others of rare occurrence, known as noble metals on account of their ability to resist oxidation.

Bashan. A country of n. e. Palestine, e. of the upper Jordan. Its most important portions are the territories known as the Hauran and the Lejah. The latter is a volcanic tract about ten miles by twenty, and in it are found the so-called "giant cities." Their houses are wholly of stone, roofs, doors, and windows included, the latter each of a solid block of stone resting on pins which revolve in sockets. These towns are now mainly unoccupied, but serve as a refuge to the Druses when attacked by Turks or Bedouins, as the territory is practically impregnable. The dates of these cities are uncertain, but may easily be as early as sometimes fixed, *i.e.*, 1000 B.C., at least in many cases. Biblically mentioned for its great oak woods and its large and fierce herds of cattle.

Bashi-Bazouks. Irregular Turkish troops, usually mounted, living by plunder and violence.

Bashkirs. Tribe of Mongol descent, near the Ural Mts., subject to Russia since 1556; Mohammedans, numbering ab. 750,000.

Bashkirtseff, MARIE, 1860–1884. Russian artist and autobiographer, living in Paris from 1878. Her *Journal*, pub. 1887, attracted much attention.

Basibranchials. Medial ventral series of cartilages, which unite the branchial arches of fishes; sometimes covered with fine teeth.

Basic. Crystalline rocks having a small percentage of silica, especially in a free condition.

Basicerite. Joint next to the basal one in the Crustacean antennæ. It bears the representatives of the exopodite and endopodite of the other appendages.

Basicity. Number of hydrogen atoms, replaceable by metals, contained by an acid. *E.g.*, if an acid has one such atom, it is monobasic; if two, dibasic.

Basicranial Cartilage. See PARACHORDALS.

Basic Salts. Derived from a base by neutralizing a portion of the hydrogen by an acid; as, $Bi(OH)_2NO_3$.

Basidia. Short, club-shaped stalks on which the basidiospores of the larger Fungi are borne.

Basidigitals. Metacarpals and Metatarsals.

Basidiomycetes. Sub-class of Fungi, including the larger species, mushrooms, toadstools, puff-balls, etc., saprophytic on various organic substances, such as humus, rotton wood, and the bark of trees and shrubs.

Basidiospores. Produced by many of the larger Fungi, as mushrooms and toadstools. They are borne on short processes, called basidia.

Basientello. In s. Naples. Scene of Otho II.'s defeat by Greeks and Saracens July 13, 982.

Basifacial Cartilages. *Trabeculæ cranii.*

Basifugal. In botany, growth or changes which take place away from or proceeding from the base of an organ.

Basigynium. In botany, elongated torus or receptacle of a flower.

Basihyal. Median ventral bone, uniting the two halves of the hyoid arch in fishes. It lies in the tongue, and is also termed entoglossal.

Basil. Several plants of the Mint family, as *Calamintha clinopodium* of Europe and N. America, and various species of *Kœblia*. *Calamintha nepeta* is the Basil Thyme.

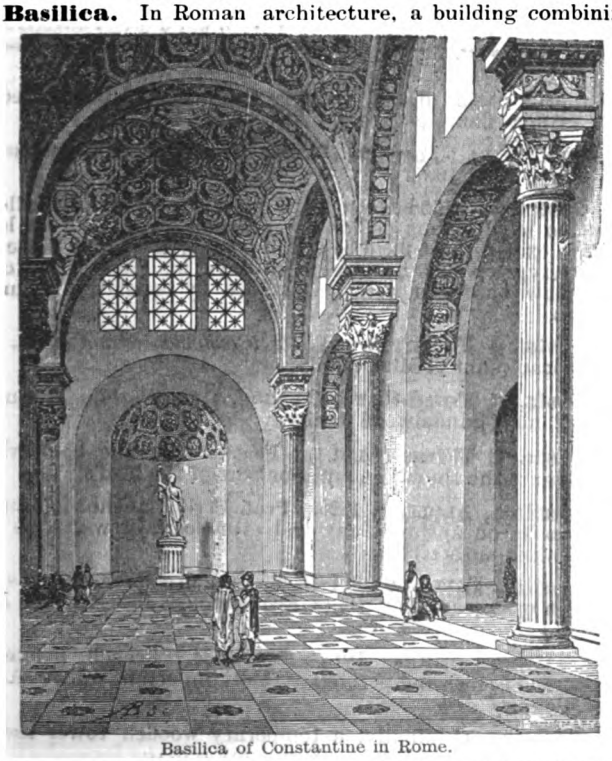
Basil the Great, ab. 329–379. Bp. of Cesarea (in Cappadocia) 370; remarkable for devotedness, literary talent, dignity, firmness, and wise moderation; a noted letter-writer.

Basil I., 820–886. Byzantine emperor 867; conqueror of Asia Minor.

Basil II., 958–1025. Byzantine emperor 975; conqueror of Bulgaria.

Basilar Plate. Cartilage which develops at base of brain through fusion of the parachordals, and is the foundation on which the skull develops.

Basilica. In Roman architecture, a building combining



Basilica of Constantine in Rome.

the uses of an exchange and a court of justice, and most nearly answering to a modern townhall. It is mainly noteworthy as having furnished the model for the earliest Christian churches, comprising, as it did, the originals of the nave, aisles, clerestory and apse, which became the principal structural divisions of Romanesque and Gothic cathedrals. See ARCHITECTURE.

Basilica. Code of Byzantine laws prepared ab. 880–900.

Basilides. Egyptian Gnostic, ab. 130; founder of a sect which bore his name.

Basilisk. Fabulous serpent (classical and mediæval), so venomous as to break stones and blast vegetation with its breath; terrified other serpents with its hiss, and destroyed man with a glance; said also to travel with half its body erect. Now a harmless lizard, family *Iguanidæ*, of tropical America.

Basin. Hollow or trough in which strata of later date have been deposited, as the basins of London and Paris, lying in the Cretaceous rocks and filled with Tertiary deposits.

Basioccipital. Bone which bounds the *os magnum* of the skull, ventrally. Not a distinct bone in Man.

Basiophthalmite. Proximal or basal joint of the eyestalks of the Crayfishes and other *Podophthalmia*.

Basipetal. Growth near or proceeding toward the base of an organ.

Basipodite. Distal joint of the protopodite, or that joint which carries the two rami (exopodite and endopodite); second joint, counting from the body, in a Crayfish's leg.

Basipterygoid Process OF BIRDS. Projection on each side of the sphenoid which articulates with the corresponding pterygoid.

Basirostral Bristles. At base of the beak of some birds.

Basisphenoid. Bone formed by fusion of the trabeculæ cranii at base of brain just in front of the basioccipital. Not a distinct bone in adult man, but represented by the part of the human sphenoid lying posterior to the sella turcica.

Basitemporal. Process of the parasphenoid underlying the tympanic region in *Ichthyopsida*. In birds, a large bone in same region.

Basket. Vessel for carrying produce, made of woven twigs, known to all races in the earliest times, depicted in the most ancient sculptures and found in all literatures.

Basket-Ball. Game of very recent origin, intended as a substitute for football, chiefly in gymnasia and among girls. It may be played in any hall or out-of-doors; no limits of surface are prescribed, nor are the numbers engaged limited, although there are usually at least five and not over nine on a side. The ball, a large round one, inflated like a football, is tossed up in the middle of the playing surface, and each side then endeavors under certain rules to place it in the opponent's goal, which is a basket hung at the end of the field or hall. The players are allowed to throw the ball or bound it, but cannot run with it, strike it with the closed fist, or kick it; neither can they tackle, shoulder, push, or trip an opponent. One point is scored for the opponents upon any foul or violation of a rule; three points is the value of a goal. The score at the end of two twenty-minute halves decides the game.

Basket Work. In fortification, fascines, gabions, hurdles, watling, and other siege material, which are formed by weaving withes and stakes together; usually employed in the saps and field works as revetments.

Basement. That part of a building wholly or in part below the level of the ground. In architectural use it signifies especially the continuous wall which supports a colonnade or arcade.

Basnage de Beauval, JACQUES. 1653–1723. French Protestant, exiled to Holland 1685. He wrote a *History of the Church*, 1699, in answer to Bossuet, and one of the Jews in 5 vols., 1706, tr. 1708.

Basommatophora. Sub-group of the *Pulmonata*, including forms having eyes at the base of the two cephalic tentacles. They resemble the *Tectibranchiata*. There are three sections, *Gehydrophila* (*Auriculidæ*), *Hygrophila* (*Limnæus*, *Planorbis*), and *Thalassophila* (*Amphibolidæ*, etc.).

Basques. Race inhabiting the Pyrenees Mountains, on the Bay of Biscay. Navarre and other adjacent provinces have to a certain extent an admixture of Basque blood. They are proud, simple, and independent; some ethnologists think them the relics of Iberians which once inhabited all Western Europe, including Britain and n. Africa. Archæologists identify them

with the neolithic remains found in caves. See NEOLITHIC CAVES. The ancient Britons who were conquered by the Gaelic and Cymric Celts, and later by the Romans, Saxons, etc., are supposed to represent this Iberian stock, now found incorporated as to blood mainly in the Welsh. Similarly in France and Spain, the Gauls drove the Iberians into the mountains. The Basque language, or Eskara, seems to be related to no other European tongue, and is probably descended from the old Iberian. Its literature, however, is almost wholly modern.

Bas-relief. Properly *low* as distinct from *high* relief; but the word is applied to all relief sculpture.

Bass. Deeper part in music, and fundamental tone in harmony; the lowest male voice. As an adjective, applied to a number of instruments because of the gravity of their tones, as bass-viol and bass-drum.

Bass. The true Bass, of which *Roccus lineatus* (Striped Bass or Rock fish) is the type, belongs to the family *Labracidæ*. The *Centropristis* (Black-fish or Sea Bass) belongs to the nearly related family *Serranidæ*. The *Micropterus* (Black Bass) of fresh waters belongs to the *Percidæ*, but authors have differed much in locating these genera, some placing *Micropterus* with the *Centrarchidæ* (Sunfishes) and *Roccus* with the *Serranidæ*. The first two differ mainly in color, and the first grows the larger. *Micropterus* differs from the others in having a well-developed supplementary maxillary bone, oblique mouth, no teeth on tongue, the preopercle not serrate, and it has a low, spiny dorsal. *Roccus* frequents estuaries, spawns in May, and over two million eggs may be produced. The average weight of these fish is twenty pounds; but five times this weight is sometimes attained. *Micropterus dolomieu* is the Small Mouthed and *M. salmoides* the Large-Mouthed Black Bass, which has also larger scales. Like the Sunfishes, they prepare nests, and guard the eggs, which hatch inside of two weeks. Four to eight pounds weight is attained, and maturity is reached in three years. They hibernate during winter. As a game fish the Black Bass is considered to lead even the Trout and Salmon.

Bassæ. Sight of a Greek temple-ruin near Phigalia in Arcadia. The exterior colonnade is well-preserved. Design was by Ictinus, architect of the Parthenon, and date ab. 480 B.C. The order of the interior was Ionic and of the exterior Doric, one of the rare exceptions to the general use of one order in one temple.

Bassano. Town of n. Italy, where the Austrians were defeated by the French, Sept. 8, 1796. It is walled and has six

Bassano.

gates, one of which and a bridge are by Palladio. Printing and silk and other industries are carried on here. The tower of Ezzelino contains a library. Pop. ab. 13,000.

Bassano, JACOPO (DA PONTE), 1510–1592. Venetian painter. —His father, FRANCISCO, 1475–1530. and his four sons, were noted artists.

Basselin, OLIVIER, ab.1400–1450. French lyric poet. The songs pub. under his name in modern times are supposed to be by Jean le Houx, toward 1600; he imitated B.'s original *Vau de Vire*, whence the word Vaudeville.

Basset Edge. In field geology, edges of the strata where they crop out at the surface.

Basset-Horn. Musical instrument of the clarionet family, now almost out of use. It has an important part in Mozart's *Requiem*.

Bassompierre, FRANÇOIS, BARON DE, 1579–1646. Marshal of France 1622; imprisoned by Richelieu 1631–42. His *Memoirs* were written in the Bastile and pub. 1665.

Bassoon. Musical instrument, the *basson* of the French, *fagott* of the Germans, and *fagotto* of the Italians; so called because it can be taken to pieces and put in a bundle like a faggot; one of the most useful of the wood wind instruments of the orchestra, and the natural bass of the OBOE (q.v.); supposed to have been invented by Afranio, Canon of Ferrara, ab. 1539. It consists of a tube ab. 8 ft. long, bent upon itself, with keys; its tone is produced by the vibration of a double reed at the end of a metallic crook.

Bassora, BUSSORA, or BASRA. Town on the Euphrates, 60 m. from Persian Gulf, founded by Omar 636. It belongs to Turkey and has an important commerce. Pop. ab. 40,000.

Bass Rock. Islet near the mouth of Firth of Forth, Scotland. St. Baldred died here in a hermitage 756. Last stronghold of the Stuarts. Capitulated April, 1694.

Bass Strait. Passage between Australia and Tasmania, in the Southern Ocean; width, 129 m.

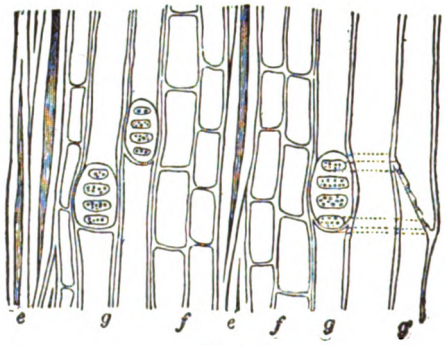
Bassus, AUFIDIUS, 1st century Roman orator who wrote on the German wars, also a general history, continued by Pliny the Elder.

Bassus, CASSIANUS, 911–959. Probable author or compiler of a work on agriculture, *Geoponica*, still extant.

Basswood. See LINDEN.

Bast, or PASHT. Cat-headed goddess of Egypt, a form of Isis. She typifies the heat and light of the sun. Cats were sacred to her, and were sent from all parts of Egypt to be buried at Bubastis, to which annual pilgrimages were made.

Bast. Vegetable tissue, occurring especially in the inner bark of plants, both woody and herbaceous, consisting of greatly elongated cells of small diameter and a high degree



Bast.

e, bast fibers; *f*, cells of soft bast; *g*, vessel of soft bast, with four perforate sieve-plates seen on the surface of an oblique septum; *g'*, section through septum and sieve-plates.

of tensile strength, and yielding the principal fibers used in the arts, as flax, hemp, etc. Also known as Liber.

Bast, CUBA. *Paritium elatum.* Tree of the Mallow family, native in West Indies.

Bastard. One begotten and born out of lawful wedlock; has no legal claims on his parents, and owes them no legal duties except those fixed by statute; inherits neither name nor property, nor has he any heirs save his issue. The common law has been greatly modified by legislation in many States.

Bastard Pennyroyal. *Trichostema dichotomum.* N. American plant of Mint family.

Bastard Toad-flax. *Comandra umbellata.* N. American plant of Sandalwood family.

Bastard Wing (ALULA). Feathers on the bone which represents the thumb on anterior part of the bird's wing.

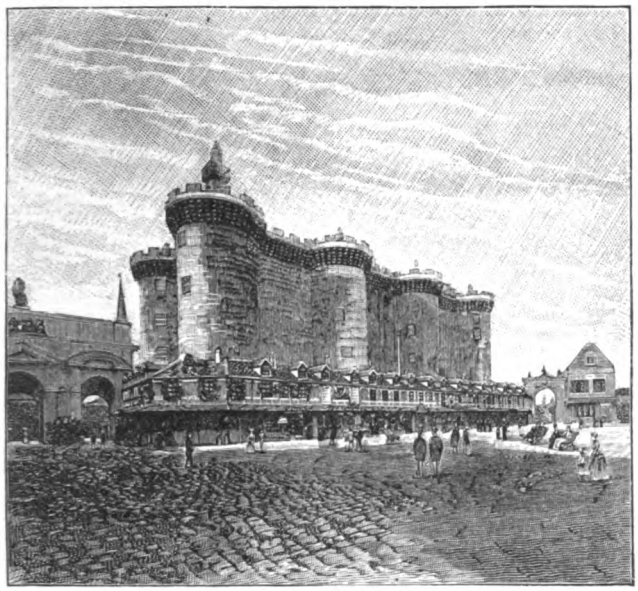
Bastian, ADOLF. b. 1826. Prof. Berlin; author of numerous books on anthropology and ethnology, in which he is a recognized authority.

Bastiat, FREDERIC. 1801–1850. French economist. His best known works are *Sophismes Economiques*, 1845–48, and *Harmonies Economiques*, 1849.

Bastien-Lepage, JULES, 1848–1884. French painter of historical scenes and portraits. Most important work in America, *Joan of Arc.*

Bastile. Originally, a temporary wooden tower used in warfare; hence any tower or fortification in the form of a tower. Especially, a castle begun by Charles V., king of France, 1369, for

the defense of Paris against the English; completed in 1383 and afterward used as a State prison. It was destroyed by the French populace July 14–15, 1789.

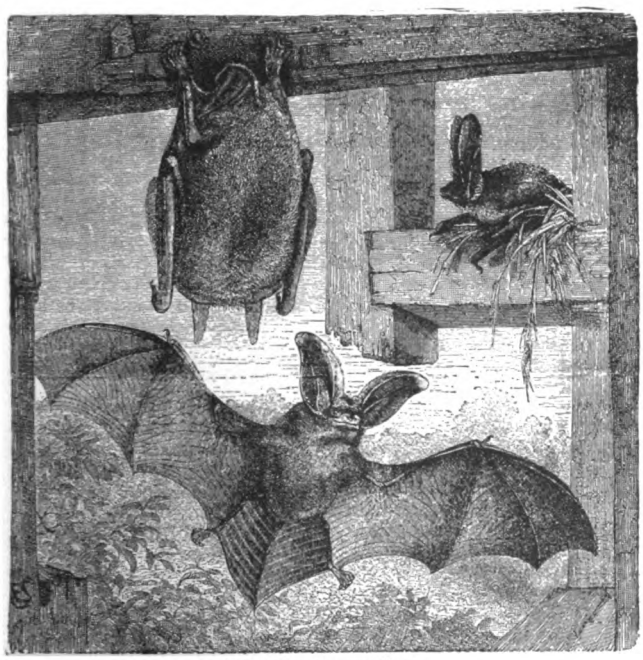


Model of Bastile.

Bastion SYSTEM OF FORTIFICATION. This comprises all the methods in which the salient angles of the polygon inclosing the site to be defended are occupied by Bastions. A bastion is pentagonal in plan and consists of two faces meeting at an angle greater than 60°, two flanks inclined to the faces at an obtuse angle, with the fifth or gorge side omitted. Each is united to the one adjacent by a curtain, whose length depends on the range of musketry fire. The lines joining the salients are the exterior sides, while the lines of the curtains are the interior sides of the polygonal site. This system formerly possessed many advantages, whose relative importance is now greatly diminished. Its ditches are swept by the fire of the work itself; it brings a strong flank and cross-fire to bear in front of the faces and curtains, and along the approaches of the besieger on the capitals. Among the many methods of this system are those of Vauban, Cormontaigne, Noizet, etc., military engineers who have made improvements in it by modification of its original simple plan.

Basutoland. British colony in s. Africa, containing 578 Europeans, 218,324 Basutos. Area 9,720 sq. m., surrounded by Natal, Kaffraria, Cape Colony, and Orange Free State.

Bat. See CHEIROPTERA. One group, comprising large and



Bat (*Plecotus auritus*).

fruit-eating Bats, the *Megacheiroptera* or *Frugivora;* the other, small insect-eating or blood-sucking forms, the *Microcheiroptera* or *Insectivora*. To the first sub-order belong the *Pteropodidæ* or Flying Foxes of the warmer parts of the Old World. They sometimes eat small animals and have well-developed canines, but the molars are tuberculate and the intestine long, as adapted for vegetable food. The tail is rudimentary and the index as well as the thumb bears a claw. Some have a spread of wing of four feet or more. The second sub-order includes five families: *Rhinolophidæ* (Horse-Shoe Bats), having a crescentic membrane developed on the nostrils, and there is no tragus. *Nycteridæ*, Old World Bats, with leaf-like folds on the nose, very large ears that have a tragus, or little ear, within the large pinna. Also termed *Megadermidæ*. The typical Bats are the *Vespertilionidæ*, about 160 species of small insect-eating forms, with cuspidate or insectivorous molars. They are widely distributed over the temperate regions. They have no nasal appendages, and the tail is quite long. The *Emballonuridæ* include tropical Bats, of insectivorous habits, with thick legs, tail more or less free from the interfemoral membrane. *Phyllostomidæ*, including the Vampires, mostly South American, and Neo-Tropical. Some, with sharp incisors and large canines, suck the blood of sleeping animals as in *Desmodus* and the Javelin Bat, which has a spread of wing of two feet. Some are frugivorous. Some have nasal appendages. Consult also: GYMNORHINA, PHYLLORHINA, VESPERTILIA and EMBALLONURIA.

Batavi. German tribe inhabiting the Netherlands; conquered by Germanicus.

Batavia. Capital of the Dutch possessions in the East Indies; founded 1619; on n. w. shore of Java. It has an extensive commerce. Pop. 96,000.

Batavian Republic. Established in alliance with France 1795. It became the Kingdom of Holland June 5, 1806.

Bates, ARLO, b. 1850. American novelist and poet. *Mr. Jacobs*, 1883; *A Wheel of Fire*, 1885.

Bates College. Founded 1863 at Lewiston, Me., by Free Baptists. It has 7 professors, 190 students, and a library of 11,700 vols.

Bates, THOMAS, 1775–1849. English agriculturist and breeder of Short Horn cattle. He originated and successfully bred for forty years the famous "Duchess" family, probably the most famous family of cattle ever bred.

Bates, WILLIAM, D.D., 1625–1699. English Puritan. *Lives*, 1681; *Four Last Things*, 1691; *Harmony of Divine Attributes*, 1697.

Bath. Ancient city of Somersetshire, England, on the Avon. Watering place with chalybeate springs. Pop., 1891, 51,843.

Bath, KNIGHTS OF THE. Order established in England 1399; revived by George I. 1725; remodeled by the Prince Regent 1815; enlarged 1845. It has now 3 classes: G. C. B. (Grand Cross Bath), K. C. B. (Knight Commander Bath), and C. B. (Companion Bath). Badge, a crimson ribbon.

Bathmism. Vital force; principle of Life in Matter.

Bathmodont Dentition. Molar teeth of the amœbodont-lophodont series, in which the tubercles on the crowns of the upper molars have developed as follows: the posterior, outer, has become a longitudinal crescent; the posterior inner, undeveloped; the two anterior, united by an oblique ridge, as in *Bathmodon* (*Coryphodon*), an Eocene mammal.

Bathometer. Any instrument for sounding depths. Sometimes the depth is indicated by the pressure of the water on air in a chamber reached by a tube filled with some liquid. For great depths the line is of fine steel wire. Nearly 4,700 fathoms have been measured in this way. Thompson's instrument incloses a glass tube open at the bottom and lined with a pigment which is dissolved by the water forced upward by pressure; the height dissolved indicates the depth.

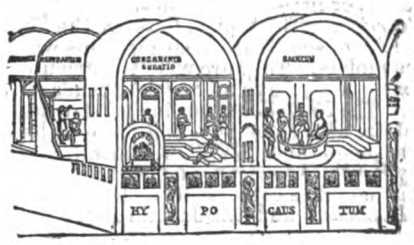
Bathory, SIGISMUND, d. 1613. Prince of Transylvania (e. Hungary), 1581–98.

Bathory, STEPHEN. Prince of Transylvania 1571–75; king of Poland 1576–86.—His niece, ELIZABETH, Countess Nádaschy, murdered 650 girls, and d. in prison 1614.

Baths. These are termed cold, tepid, warm, and hot, when between 40° and 60°, 85° and 95°, 95° and 100°, and 100° and 110° respectively; medicated when containing medicinal substances, and electric when one pole of a battery is connected with the water and the other with the bather. Hot and warm baths are employed in medicine principally to relieve convulsive attacks or retention of urine, to overcome muscular spasm and mild forms of wakefulness. Cold baths are used to reduce the temperature in all kinds of fever and in sunstroke. The

medicated variety is rarely employed save in skin diseases, and the electrical only to apply electricity to a large surface of the body. Too frequent bathing may prove injurious to some, causing a form of anæmia. Baths should not be taken within three hours after eating.

Baths, ROMAN. Constructions supplied with every facility and luxury, and often of vast extent. Both the Russian and Turkish bath systems of our own day are derived from them, through the Byzantine Empire. The buried town of Pompeii illustrates in several different buildings all the details and arrangements of such constructions. Ruins of others are found in many former territories of the empire, not excepting England, where the imposing ruins of Bath have been lately excavated. The Baths of Caracalla at Rome are the most noted, but are in utter ruin. They had accommodation for 1,600 bathers, including the air bath, the hot bath, the plunge, and the swimming bath. Such buildings were also laid out as public club-houses for the leisure hours of the citizens, included reading rooms, libraries, gymnasiums, lounging rooms, etc., and were lavishly adorned with sculptures.



Walls of the Thermæ of Titus at Rome.

Bathurst Island. (1) In Arctic Ocean. (2) Near Melville Isl., off n. Australia.

Bathurst, WILLIAM HILEY, 1796–1877. English divine and poet. *Hymns*, 1831; tr. *Virgil's Georgics*, 1849.

Bathybius. Slimy deposit of colloid calcium sulphate, thrown down out of sea water (or extracted from specimens dredged from the deep sea) by alcohol, and once supposed by Huxley to be the simplest form of protoplasm. A slimy deposit, containing calcareous discs, covers parts of the sea bottom with a thick layer; as this exhibits gelatinous contractile movements its protoplasmic nature has been suspected; but it is probably purely inorganic, although organic, not-living substances, allied to *Zoöglœa*, may be present. A net-work of free protoplasm like mycetozoan plasmodia occurs in large masses in Smith's Sound, and has been called *Protobathybius* by Bessels.

Bathymetric Distribution. Occurrence of organisms with reference to altitude, on land, and depth, in the seas. In oceanic distribution this is partly regulated by the depth but more especially by the temperature. The Littoral Zone includes the sea bottom uncovered at low tide. From this to a depth of 15 fathoms extends the Laminarian Zone. Then come the Coralline Zone, which extends from 15 to 50 fathoms, and the Deep-Sea Zone, from 50 to 400 fathoms in depth. Below this is the Abyssal Zone. Abundant and peculiar forms exist in the ocean down to 4,000 or more fathoms, including Foraminifera, Radiolaria, Echinoderms, Siliceous Sponges, Fishes, etc. The general ocean surface constitutes the Pelagic Zone, swarming with Foraminifera, Hydrozoa, Pteropods, etc.

Batidaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledones*, including but one genus and one species, found in the tropics of America.

Batides (BATOIDEA). See RAJIDES.

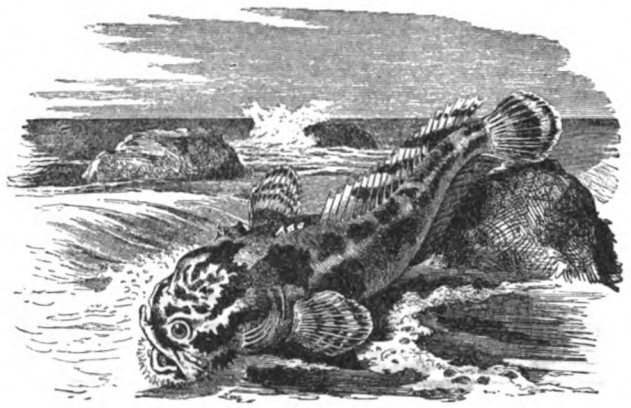
Baton, ab. 280 B.C. Athenian poet of the New Comedy, whose plays satirized the philosophers; only fragments remain.

Baton Rouge. Capital of Louisiana since 1847, save that, for a few years after the Civil War, New Orleans was the seat of the State government; taken by Union forces May 7, 1862; U. S. garrison attacked Aug. 5, 1862, by 5,000 Confederates, who were repulsed. Pop., 1890, 10,478.

Baton-Sinister. The heraldic sign of bastardy. It resembles a marshal's baton, running diagonally upward from left to right through the center of the shield, but not extending all the way. Bar-sinister is the common, but inaccurate, name.

Batrachia. See ANURA. Some authors use the term as equivalent to AMPHIBIA.

Batrachidæ. Family of Acanthopterygian fish, including *Batrachus tau*, the Toad-fish, which lurks on oyster beds. It is locally known as Oyster-fish, or "Sally Growler." It has a repulsive appearance, a large flat head, expanded, soft pectorals, and a wide mouth with blunt teeth. When it bites, it holds on like a bull dog. A related genus, *Thalassophryne*


Batrachus grunniens.

has poison glands at the bases of the dorsal and opercular spines.

Batrachospermaceæ. Family of fresh-water algæ, of great beauty, resembling the eggs of certain aquatic animals, sometimes known as "frog-spawn."

Battas, or **Battaks.** Cannibal race of n. Sumatra, numbering 300,000, not yet completely subdued by the Dutch.

Battalion. Body of troops, consisting of two or more companies, commanded by a major.

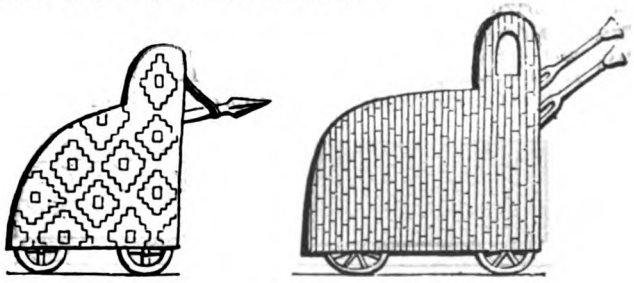
Battel, TRIAL BY. Introduced into England by the Normans; based on the assumption that God would miraculously help the innocent combatant; not formally abolished till 1819.

Batten. Strip of wood nailed upon a surface, either for ornament or to prevent warping.

Batter. Inclination from a vertical line of the face of a wall, usually expressed in inches per foot of height. Thus, a batter of $1\frac{1}{2}$ inches to a foot means that the wall deviates sidewise $1\frac{1}{2}$ inches in each vertical foot.

Batter Post. Post placed in a bridge truss to strengthen the portal against an unusual shock, such as might occur in a derailment.

Battering-Ram. Said to have been invented by a Spartan, and employed by Pericles ab. 441 B.C.


Assyrian Battering-Rams.

Battery. Two or more pieces of artillery; also the emplacement of guns for attack or defense. In military engineering batteries are classed according to their use, the direction of their fire, and the method of construction of their protecting cover. We thus have Barbette, Covered Breaching, Direct, Oblique, Raised, Horizontal, Sunken Enfilading, Indented, Reverse, Counter, and Masked batteries.

Battery. General name given to the armament of a ship; it is divided usually into primary and secondary.

Battery. (1) Set of stamps working together in a stamp-mill. (2) Mass of heavy timber used to support the roof or hanging wall of mines.

Battery Cells. See NETTLE CELLS.

Battery, ELECTRIC. Leyden jars joined either in cascade or in surface.—GALVANIC. Cells or elements joined in "series," *i.e.*, with the negative pole of one joined to the positive pole of the next, and so on to the end; or joined in "multiple arc," *i.e.*, with all the positive plates connected, and all the negative ones joined together. In the first case the difference of potential of n cells is n times that of one cell, but, the resistance is n times greater too, so that if short circuited the current will be the same as that from one cell. In the second

case the difference of potential is the same as that of one cell but the resistance only $\frac{1}{n}$th as great.

Battery, FIELD. Four or six guns of field artillery, with limbers, caissons, wagon, and forge. The guns, with their limbers and the caissons, are drawn by four or six horses each, and thus have great mobility. When the cannoneers are mounted, it can move with cavalry, and is called a horse battery.

Battery, MORTAR. A mortar is usually fired at an angle of 45° and sometimes of 60°. Its emplacement is ordinarily a thick embankment, behind which the mortars are placed in groups of four or six, and this parapet screens them from direct vision of the enemy.

Battle. Collision between two opposing armies. It results from the tactical operations directed by the commanders of each for the purpose of weakening or destroying the unity of the opposing army. It is generally initiated by minor actions, called combats, which the smaller fractions of the contending armies enter upon to gain every possible advantage before the general engagement takes place. Battles are classed as *defensive*, *offensive*, and *defensive-offensive*. In a defensive battle, an army chooses a position in which to await the enemy, aiming mainly to hold the position and repulse the foe. An army seeks the enemy in an *offensive* battle and attacks him wherever found. In a *defensive-offensive* battle, a position is selected and held until the attacking enemy is weakened, when a vigorous counter attack is delivered at a promising moment for victory.

Battle-Axe. Weapon of varying size and shape, formerly used by many nations.

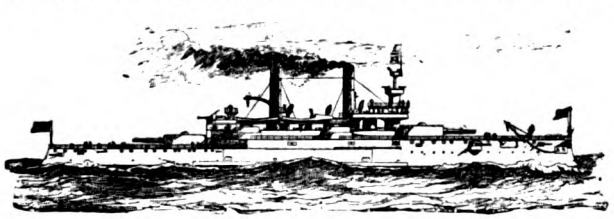
Battle Creek. Town of Calhoun co., Mich., on Kalamazoo R. Pop., 1890, 13,197.

Battledore and Shuttlecock. Game played with a shuttlecock, usually made of cork crowned with feathers, which is struck with a battledore, commonly made of parchment stretched over a wooden frame. It is common amusement of Japanese girls, where the shuttlecock, *hago go*, is made of a hazel nut, and the battledore, *hago go ita*, of board. The Chinese and Koreans kick the shuttlecock. The game is common among the American Indians. The Zunis make their shuttlecocks of corn husks and turkey feathers, and call it *Lá-po-po-wé*, the "Feather-ball Game."

Battlement. In military architecture, a parapet with alternate elevations (merlons) and depressions (crenelles), also called a crenellated parapet. Its original use was to provide shelter for the besieged behind the merlons, while affording them opportunity to fire through the embrasures of the crenelles. The battlement was employed especially in late English Gothic as a decorative feature upon civil and ecclesiastical edifices. In modern buildings it is applied to denote military architecture. The openings in the earth parapets, through which the guns of a battery deliver their fire, are called embrasures.

Battle of the Gauges. A controversy, of particular interest from 1830 to 1850, as to the most economic distance, called the gauge, between the two rails of a railroad track. Gauges of 7 ft., 6, 5, 4 ft. 8½ in., and 4 ft. 6 in. were in use, and each was claimed by its advocates to be the best. The battle was finally practically decided by the agreement arrived at in England ab. 1848, that all new roads should be built with the standard gauge of 4 ft. 8½ in.

Battleship. Name given to that class or type of warship which is the largest and most powerfully armed. It is practically a floating fort. They may have their primary battery, or heaviest guns, either in barbettes or turrets; the former is now the more popular form. One of the most recently-built battleships is of 15,000 tons displacement, 12,000 indicated horse-power, protected by 14 inches of carbonized steel armor on her



U. S. Battleship Iowa.

barbettes and 9 inches on her belt, which extends from 10½ feet above her water line to 5½ feet below: her armament will consist of four 12-inch 50-ton breech-loaders and a secondary battery of twelve 6-inch and twenty-six rapid-fire guns of smaller caliber; five Whitehead torpedo-tubes, four of which will be submerged; estimated speed 17.5 knots; cost $5,000,000. The following table will give the names, displacement, indicated horse-power under forced draft, highest speed, and caliber of gun carried by the most powerful battleship of each nation owning or building warships of this type:

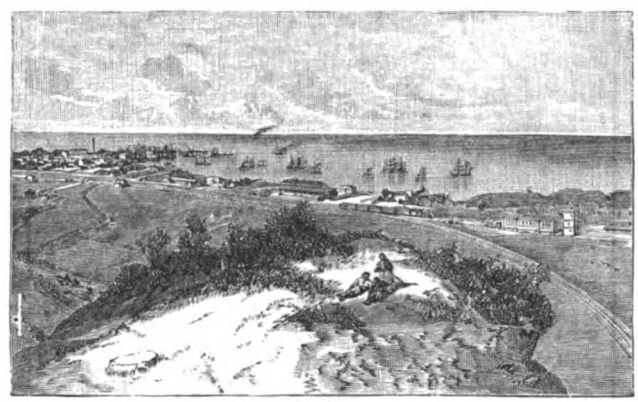
Nation.	*Name.*	*Displacement Tons.*	*Horse-power.*	*Speed Kn'ts*	*Largest Gun Inches.*
Austria.	Kronprinz Erzherzog Rudolph.	6,870	7,500	16.0	12.
Brazil.	Riachuelo.	5,700	7,300	16.7	9.
Chili.	Capitano Prat.	6,900	12,000	18.3	9.5
China.	Chuen-Yuen.	7,430	6,200	14.5	12.
Denmark.	Iver-Hvitfeldt.	3,260	5,100	15.6	10.2
France.	Bouvet.	12,200	13,000	17.5	11.8
Germany.	Woerth.	9,842	9,500	16.0	11.0
Greece.	Psara.	4,885	7,000	17.0	10.6
Great Britain.	Magnificent.	15,000	12,000	17.5	12.0
Italy.	Sardegna.	13,860	22,800	19.0	13.0
Japan.	Fujiyama.	12,200	14,000	16.5	12.0
Russia.	Tria Sviatitelia.	12,480	10,600	16.0	12.0
Spain.	Pelayo.	9,900	8,000	16.0	12.6
United States.	Iowa.	11,286	11,000	16.5	12.0

Battoni, POMPEO GIROLAMO, 1708–1787. Italian painter. His best-known work is a *Magdalen* in Dresden.

Battue. Method of hunting in which beaters drive the game toward a point where the sportsmen are stationed.

Batu Khan, d. 1255. Grandson of Genghis Khan; commander of the Mongol army which entered Europe 1235, sacked Riazan, Moscow, Kozelsk and Kieff, and defeated the Hungarians near Tokay, Dec. 1241.

Batum. Port on e. shore of Black Sea, ceded to Russia



Batum.

1878; important for its exportation of petroleum, brought from Baku on the Caspian by a railway completed 1883. Pop. ab. 27,000.

Baudelaire, CHARLES PIERRE, 1821–1867. French poet, critic, and translator of E. A. Poe, 1856–58. *Th. Gautier*, 1859; *Wagner*, 1861. His poems, as *Fleurs du Mal*, 1857, are of the extreme "*decadent*" style.

Baudissin, WOLF HEINRICH FRIEDRICH KARL, GRAF VON, 1789–1878. German translator of Shakespeare and Molière.

Baudissin, WOLF WILHELM FRIEDRICH, GRAF VON, b. 1847. Prof. at Strassburg 1876, and Marburg 1881. *History of Semitic Religions*, 1876–78.

Baudission, ULRICH VON, b. 1816. German dramatic poet and novelist.

Baudry, PAUL JACQUES AIME, 1828–1886. French painter, eminent for portraits and groups; decorator of the foyer of the Grand Opera, Paris.

Bauer, BRUNO, 1809–1882. German rationalist; prof. at Bonn 1839–42. His biblical criticism was destructive. *History of the 18th Century*, 4 vols., 1843–45.

Bauer, GEORG LORENZ, 1755–1806. German Bible critic; prof. at Altdorf 1789, and Heidelberg 1805.

Bauer, WILHELM, 1822–1875. German inventor of a diving boat and submarine guns.

Bauernfeld, EDUARD VON, 1802–1890. Austrian poet, dramatist, and novelist.

Baumgarten, ALEXANDER GOTTLIEB, 1714–1762. Prof. at Frankfort 1740. *Metaphysica*, 1739; *Æsthetica*, 1750.

Baumgarten, MICHAEL, 1812–1889. Prof. at Rostock 1850–58; opponent of the State Church. *Acts of the Apostles*, 1852, tr. 1854; *Schleiermacher*, 1862.

Baumgarten-Crusius, LUDWIG FRIEDRICH OTTO, 1788–1843. Prof. at Jena 1812. *History of Doctrine*, 4 vols., 1831–46.

Baur, FERDINAND CHRISTIAN, 1792–1860. Prof. at Tübingen from 1826; very eminent biblical critic of the new or rationalistic school. *Paul*, 1845; *Church History*, 5 vols., 1853–62, tr. 1873–75.

Bautain, LOUIS EUGENE MARIE, 1796–1867. French divine; prof. at Strassburg 1819–22, and Paris 1853. *Moral Philosophy*, 1840; *Art of Extempore Preaching*, 1856, tr. 1858.

Bautzen. Town of Saxony; scene of a battle, May 20 and 21, 1813, between Napoleon and the Allies, who withdrew with loss of 13,000. The French loss was 20,000. Pop., 1890, 21,517.

Bauxite, or **Beauxite.** Hydrous oxide of aluminium and iron, in varying proportions; named from Baux, in France. It contains 60 to 80 per cent alumina, and is used for the manufacture of aluminium and compounds, first used on a commercial scale ab. 1868. Discovered in Ga. in 1881, since found in Ala. and Ark. Its present consumption in the U. S. is from 25,000 to 30,000 tons a year, 10,000 to 12,000 tons being obtained from home mines.

Bavaria. State of s. Germany. Its surface is much broken by mountains, the Alps in the extreme south and other ranges of less height in other parts. The valleys are broad and fertile. The area, including the Palatinate, is 29,292 sq. m., and the pop. in 1890 was 5,589,382, it being, next to Prussia, the most populous state of Germany. It contains valuable iron and coal mines and produces large amounts of salt. It has large manufactures, especially of cloth, iron, steel, and paper. B. was named from the Boii, who occupied it ab. 600 B.C. In the Middle Ages it was held by Ostrogoths, Franks, and then by Charlemagne; in 1070 it passed to the Guelphs, in 1180 to Otho, Count of Wittelsbach. The Duke of B. became an elector 1624,

Sketch Map of Bavaria Proper.

and was made a king by Napoleon 1805, but joined the Allies 1813. A constitution was given 1818. Louis I., 1825–1848, the lover of Lola Montez, abdicated; Louis II., 1864–86, was Wagner's patron, and became insane, as did his successor, Otho. B. joined Austria in the war of 1866, and Prussia in that of 1870; becoming part of the German Empire. It is nearly three-fourths R. C. Munich is the capital.

Baxendell, JOSEPH, b. 1820. English author of *Studies on the Distribution and Theory of Rain and Temperature.*

Baxter, RICHARD, 1615–1691. Vicar of Kidderminster 1641, ejected 1662, imprisoned 1685. The most moderate, saintly, and learned of the Non-Conformists. He declined a bishopric, and was insulted by Judge Jeffries. *Saint's Everlasting Rest*, 1650; *Call to the Unconverted*, 1669.

Bay. Arm of the sea.—In engineering, span of a bridge, or a panel length in a truss; used mostly in England.—A division or compartment of a building set off from the rest not by walls, but by columns or other detached structural members. In Gothic architecture, a bay is the part of a church bounded by columns or piers and covered with a single vault, or with a section of roof inclosed by principal rafters, and, if in an aisle or clerestory, lighted by a single opening or group of openings.

Bay, LOBLOLLY. *Gordonia Lasianthus.* Small tree of Camellia family, bearing showy white flowers; native of swamps in s. e. U. S.

Bay, RED. *Persea Borbonia.* Small tree of the natural family *Lauraceæ*, native of s. e. U. S.

Bay, SWEET. See LAUREL.

Bayaderes. East Indian dancing, or Nautch-girls, sometimes wandering, sometimes attached to temples. Modern representatives of the Phœnician *Kedeshoth*, and Greek *Hierodules*, who prostituted themselves in the service of the god.

Bayaka. Tribe of Africans, of w. coast near Loango. They live in villages with straight streets, but with only sixteen huts on an average. The huts are square, with a porch, and a chimney-hole in the roof. Small bows and poisoned arrows are used. Whisky is manufactured, and smoking circles are indulged in. The hair is bound up into two spikes that stand out behind. The men tattoo their limbs, the women their faces. The children are carried in a strap hung over the shoulder. The men rule the women by playing on their superstition. Corpses are left in trees or bushes.

Bayard, PIERRE DU TERRAIL, CHEVALIER, 1475–1524. French soldier, famous as "the knight without fear and without reproach"; victor at Marignano 1515; defender of Mézières 1522.

Bayard, THOMAS FRANCIS, LL.D., b. 1828. Son of U. S. Senator JAMES A., JR., 1799–1880; U. S. Dist. Atty. for Del. 1853; U. S. Senator 1869–85; U. S. Sec. of State 1885–89; Ambassador to Great Britain 1893.

Bayazid, or BAJAZET I., 1347–1403. Sultan of the Turks 1389–1401; son of Murad I. He made conquests in Asia Minor, Bulgaria, and Greece; defeated the Hungarians and Poles at Nicopolis 1396, but was defeated and made prisoner by Tamerlane at Angora 1401.—II., 1447–1512; son of Mohammed II.; reigned 1481–1512.

Bayberry. *Myrica cerifera* and *M. Caroliniana.* E. American shrubs, also called Waxberry and Wax-Myrtle. The berries yield wax in large quantities, which is used for candles and soap.

Bay City. Capital of Bay co., Mich., on Saginaw R., 4 m. ab. its mouth and at the head of navigation. The principal business is in lumber and salt. Pop., 1890, 27,839.

Bayeux. City of Normandy, noted for its old cathedral. Pop., 1891, 8,102. The famous B. Tapestry, ab. 230 ft. long and 20 in. wide, dating probably from ab. 1100, has 72 scenes, depicting the conquest of England, and is highly valued as a cotemporary document on the costumes and manners of that age. It was known only locally till 1724.

Bayeux Tapestry.

Bayle, PIERRE, 1647–1706. French philosopher; prof. at Sedan 1675–81, and Rotterdam 1681–93. His *Historical and Critical Dictionary*, 2 v. folio, 1697, tr. 1710, is a classic. *Commentary on Luke xiv. 23* ("Compel them to come in"), tr. 1708.

Baylen. Town of s. Spain, scene of a Spanish victory over the French, July 20, 1808.

Baylor, FRANCES COURTENAY, b. 1848. American novelist. *On Both Sides*, 1885; *Behind the Blue Ridge*, 1887.

Baylor University. Founded at Independence, Texas, by Baptists 1845; began work 1851; removed to Waco, Tex., 1881–82. It has 25 instructors and ab. 600 students.

Bayly, ADA ELLEN ("EDNA LYALL"). English novelist. *Donovan*, 1882; *We Two*, 1884; *Knight Errant*, 1887.

Bayly, LEWIS, D.D., d. 1631. Bp. of Bangor, Wales, 1616. His *Practice of Piety*, ab. 1612, was long popular.—His son THOMAS was imprisoned for a defense of Episcopacy, 1649; became a R. C. and wrote *End to Controversy*, 1654.

Bayly, THOMAS HAYNES, 1797–1839. English lyric poet. Some of his songs were extremely popular.

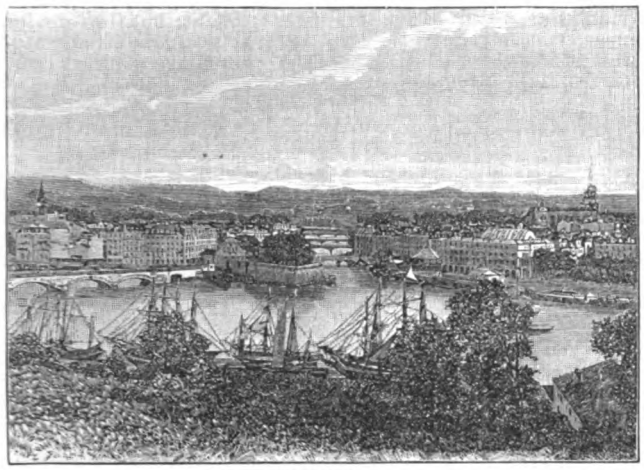
Bayne, PETER, LL.D., b. 1830. Scottish journalist, biographer of Hugh Miller 1871, and Luther 1887. *The Christian Life*, 1855.

Baynes, ROBERT HALL, b. 1831. English divine and poet.

Baynes, THOMAS SPENCER, LL.D., 1823–1887. English journalist and logician; prof. Univ. Edinburgh 1851–55, and St. Andrews 1864, ed. 9th ed. *Encyclopædia Britannica.*

Bayonet. A triangular dagger, made with a short hollow handle and a shoulder to fix on the muzzle of a rifle, so as not to interfere with the loading or firing of the piece when it is in place. A modification of the ordinary form is often used by engineer troops and is called the trowel and sword-bayonet. Said to have been invented at Bayonne, France, ab. 1650; adopted in France and England ab. 1675, but inserted in the muzzle of the gun; the socketed bayonet was introduced by Vauban 1703.

Bayonne. City of s. w. France, 4 m. from Bay of Biscay; held by England 1152–1451; besieged 1814, as often before, but



Bayonne.

its citadel resisted all assaults. Here Napoleon procured the abdication of Charles IV. of Spain, 1808. Pop., 1891, 27,192.

Bayonne. City of Hudson co., N. J., s. of Jersey City. Pop., 1890, 19,033. Large petroleum oil refineries are located here.

Bayreuth. See BAIREUTH.

Bay Salt. Salt (sodium chloride) of sea water, evaporated in brine pans by the air and sun.

Bay-Window. A projection, segmental or polygonal in plan, from the main wall of a building and forming a recess in the apartment to which it affords light. Most common in late Gothic architecture. A projecting window supported by corbels or beams and not resting upon its own foundation-wall is called an oriel-window. If segmental in plan a bay-window or oriel is often described as a bow-window.

Bazaine, FRANCOIS ACHILLE, 1811–1888. Marshal of France 1864, commander of the Imperial Guard 1869, and of the Army of the Rhine 1870; defeated at Gravelotte Aug. 18; surrendered Metz with 160,000 men and 1,800 guns Oct. 27. For this he was tried in 1873, and sentenced first to be shot, then to 20 years' imprisonment. He escaped Aug. 9, 1874, and went to Madrid.

Bazalgette, SIR JOSEPH WILLIAM, 1819–1891. Civil engineer; designer of the sewerage system of London and of the Thames embankments.

Bazancourt, CESAR, BARON DE, 1810–1865. French historian of the wars of Napoleon III. *Sicily under Norman Rule*, 1846.

Bazard, ST. AMAND, 1791–1832. French socialist; expounder, with Enfantin, of *Saint Simon's Doctrine*, 1828–30.

Bazin, HENRI, b. 1829. Civil engineer; inspector general of roads and bridges of France; experimenter and writer on hydraulic engineering.

Bazzi. See SODDOMA.

Bazzini, ANTONIO, b. 1818. Italian violinist and composer of chamber music, cantatas, psalms, overtures, and an opera, *Turandot*, 1867; since 1880 Director of the Milan Conservatory.

Bdellium. Resin produced from *Balsamodendron Africanum*, an African tree of the natural family *Burseraceæ*; also that derived from *Ceradia furcata*, a plant of the *Compositæ*, also from Africa.

Bdelostoma. Myxinoid fish, allied to the Lamprey. Its eyes are hidden beneath the skin, and are practically sightless. There are six to eleven branchial openings on each side of the neck. All species of this genus, so far as known, live in the Pacific Ocean.

Beach-Pea. *Lathyrus maritimus.* Seaside plant of the natural family *Leguminosæ*, native of the Northern Hemisphere.

Beachy Head. Sussex, England; scene of a French victory over British and Dutch fleet, June 30, 1690.

Beacon. Warning signal erected on the shore or moored in shallow water to warn mariners of approaching danger. They are built of wood, iron and masonry. It has been tried to illuminate them by electricity, but has not proved very successful.

Beaconsfield. See DISRAELI, B.

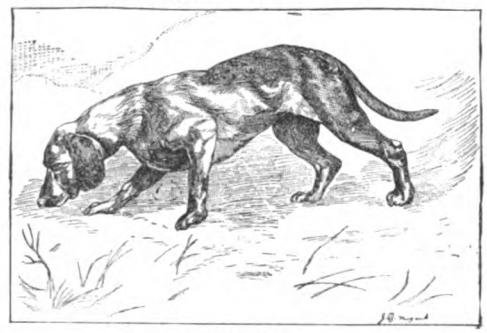
Bead. In architecture, convex molding of a semicircle or more in section.

Bead and Reel. Denoting a frequent enrichment in classic architecture of a convex molding.

Beads. Small globular, cylindrical, or ovoid objects made of various materials, especially glass, perforated and strung together for necklaces and personal decoration, and for rosaries. They are an article of commerce with barbaric nations and made at Venice and Birmingham for this use. The Venetian beads closely resemble those which were made in antiquity in Egypt, and which even then found their way to remote portions of the earth through Phœnician commerce. See ROSARY.

Bead-Tree. *Melia Azedarach*, known as Pride of India; tree of natural family *Meliaceæ*, found in all warm countries. Also, a variety of plants whose seeds are used as beads.

Beagle. Small, well-proportioned hound, about one foot high, with long, hanging ears. Noted for its acute scent, stam-



Beagle.

ina, and tunable cry. Used in hunting the hare. Largely supplanted by the harrier, a larger hound.

Beak-Rush. Species of genus *Rynchospora* of the Sedge family.

Beale, LIONEL SMITH. F.R.S., b. 1828. English microscopist and mineralogist; prof. Univ. London. *How to Work with the Microscope*, 1858.

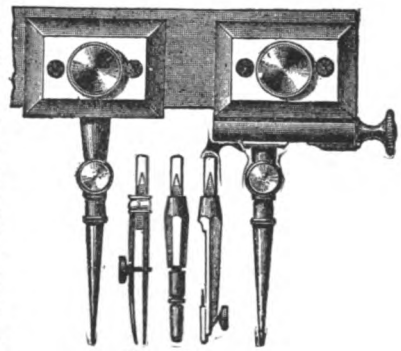
Beam. Bar laid in a horizontal position upon two supports and carrying weights which cause deflection and stress. A load concentrated at the middle of a beam causes twice as much stress as the same load spread uniformly over it. At the middle of a beam horizontal tensile stresses occur on the lower side and compressive stresses on the upper side. For a beam of rectangular section these are equal, and they may be computed from the formula,

$$S = \frac{3\,W\,l}{2\,b\,d^2},$$

in which W is the load at the middle of the beam, l its length, b its breadth, and d its depth. For example, a wooden beam 120 in. long, 2 in. wide, and 8 in. deep, loaded with 640 pounds at the middle, has there a stress S equal to 900 pounds per sq. in. A bar resting on more than two supports is called a continuous beam, and one projecting from a wall a cantilever beam. The theory of beams was first discussed by Galileo in 1638.

Beam. *Pyrus Aria.* Small tree of the Apple family, native of Europe.

Beam Compasses. Small bar having attached at one end a pencil or pen, and at the other a needle-point, so that circles of large radius can be drawn.



Beam Compasses.

Beam Engine. One in which the push and pull of the piston-rod are transmitted to the working point through a lever or beam oscillating or rocking through a small angle around a fixed center. This arrangement of engine mechanism has been approved where a vertical cylinder was to be used of large size, and a heavy fly-wheel. These two heavy masses were then

located close to the bed-plate. Or, again, as in compound or in large pumping engines, several cylinders were to be connected for synchronous motion; or as in Cornish mine-pumping engines, where the engine cylinder could not stand over the pit-mouth, the beam mechanism offers a convenient arrangement of parts.

Beam, WALKING or WORKING. In beam engines the lever which transmits the motion of the piston-rod to the working point, usually through a pitman or main connecting-rod. In the earliest engines, where the work was all done by tension, the beam was of wood, and chains were attached to sectors at the two ends of the beam to keep the respective rods in line. Later, cast-iron beams were introduced, of a form resembling two parabolas back to back, and wrought-iron built-beams have been also used. The usual walking beam of American engines is a lozenge-shaped frame of wrought-iron, which is braced and kept from deformation by a cast-iron spider which carries the center and pins. The wrought-iron strap receives the push and pull of the piston, and the cast-iron bracing is under compression only.

Beams, DEFLECTION OF. Let W=the total weight or load, D=the deflection, E=coefficient of elasticity, l=length of the beam, b=breadth of the beam, d=depth of the beam, r=radius of a round beam, w=load per linear unit. There will be four cases:

1st, Rectangular cantilever beam of uniform section loaded at the end: $D=\frac{4Wl^3}{Ebd^3}$

2d, Same loaded uniformly: W=wl, and $D=\frac{3Wl^3}{2Ebd^3}$

3d, Rectangular girder supported at both ends, loaded in center: $D=\frac{Wl^3}{4Ebd^3}$

4th, Same loaded uniformly: $D=\frac{5Wl^3}{32Ebd^3}$

If the beam is solid and round the four values of the deflection for the four cases are respectively:

$$D_1=\frac{4Wl^3}{3E\pi r^4} \quad D_2=\frac{Wl^3}{2E\pi r^4} \quad D_3=\frac{Wl^3}{12E\pi r^4} \quad D_4=\frac{5Wl^3}{96E\pi r^4}$$

When the beam is a flanged girder, let a denote the area of either of equal flanges and a^1 the area of the web. Then for the same four cases:

$$D_1=\frac{4Wl^3}{E(6a+a^1)d^2} \quad D_2=\frac{3Wl^3}{2E(6a+a^1)d^2} \quad D_3=\frac{Wl^3}{4E(6a+a^1)d^2} \text{ and}$$

$$D_4=\frac{5Wl^3}{32E(6a+a^1)d^2}$$

Bean. Name of numerous herbs or vines of the natural family *Leguminosæ*, producing edible seeds. The large garden bean is *Vicia Faba;* the Lima bean, *Phaseolus lunatus;* the kidney bean, *P. vulgaris.* The white bean so largely used as a food, having a higher nutritious value than wheat, but rather indigestible. The string beans are gardener's varieties of the *Phaseolus vulgaris*, and when eaten in their green state are not very nourishing. Beans raised in field culture are almost entirely the Pea-bean and its near relatives the Marrow and Kidney. A fairly rich warm soil is best suited for them. They are planted in May or early June in hills or drills, and cultivated much the same as Indian Corn. When ripe, the whole plants are pulled by hand or machinery, stacked in small stacks, and when dry threshed. The beans are then sorted by hand and are ready for market. The straw, pods, and imperfect beans make a useful food for animals, especially sheep.

Bean Bags. Game with cloth bag partially filled with beans. Two sides are formed, and each takes half the bags, which are placed on a table or chair at one end of each line of players. The bags are passed along each line from hand to hand, and the side which first transfers all its bags to the other end becomes the winner.

Bean Caper. Herbs of the genus *Zygophyllum*, natural family *Zygophyllaceæ*, natives of the Old World.

Bean, INDIAN. See CATALPA.

Bear (See URSIDÆ). The following species are of interest; viz., *Melursus labiatus*, variously known as Sloth Bear, Jungle Bear, Large-lipped Bear, Honey Bear, etc., of India, was once placed with the Sloths, from the general appearance of its claws and the absence of incisor teeth. Its muzzle and lips are long and mobile, the hair black and shaggy, and it dwells in caves. It is ferocious in the wild state, but easily tamed in captivity. It is herbivorous, but is given to robbing the ground nests of ants and bees. *Helarctos melayanus*, the Sun Bear of Malaysia, is also fond of honey and has very long claws and extensible tongue. It commits depredations on plantations, destroying trees, eating fruits, grains, vegetables, and killing pigs and sheep. It is a fearful antagonist when cornered or wounded, but is tamable and makes a fun provoking menagerie specimen. The Spectacled Bear (*H. ornatus*) of the Andes has some features resembling the last, in its pelage, habits and habitat. *Ursus arctos* of the Sub-Arctic and North Temperate regions is the Brown Bear. It is about six ft. long and three ft. high. The she-bear is celebrated for its revengeful ferocity when her cubs are taken or destroyed. The Syrian Bear of Palestine is closely related to the preceding. *Ursus Americanus*, the Black Bear of N. America, is comparatively harmless, mainly herbivorous, and noted for its hibernating habits. The males prefer caves and lose little or no fat; but the females bear two to five young in midwinter (after seven months' gestation), and prefer hollow trees. The young are suckled until

Grizzly Bear.

spring and then the mother is thin and the young have grown to the size of small pups. The weight of the adults ranges from 200 to 400 pounds. The Cinnamon Bear is a paler variety of the Black Bear. The Grizzly (*U. horribilis*) is the largest of the *Ursidæ*, attaining a weight of 800 lbs. and a length of nine feet. The color is grayish brown; in diet it is carnivorous; its home is in the Rocky Mts., and it attacks man on slight provocation, even the Bison is an easy prey, but the Puma or American Panther can vanquish this untamable fiend. *Thalassarctos maritimus* is the White or Polar Bear, characterized by large size, long neck and feet, thick whitish fur and black claws. It lives on seals, fish and grass. Only the pregnant female hibernates; it has two cubs which it watches with extraordinary affection. Polar Bears are restricted to the northern marine ice floes. They are not especially ferocious, and the young may be easily tamed.

Bear-Baiting. Common amusement of high antiquity, practiced in England in the 16th and 17th centuries, in which bears were tied and worried by dogs; forbidden 1835.

Bearberry. *Arctostaphylos Uva ursi.* Low trailing plant of the Heath family, native of the northern hemisphere.

Bearberry.

Beard. Worn usually by the Greeks till ab. 300 B.C. Plutarch gives as a reason for shaving that they might not be pulled by the beard in battle. A long beard became the badge of a philosopher; the custom of shaving lasted till Justinian. Scipio Africanus was the first Roman who shaved daily.

Beard, GEORGE MILLER, 1839–1883. American physician, specialty, diseases of the nervous system. Prolific writer. *General Electrination; Stimulants and Narcotics.*

Beard, RICHARD, D.D., 1799–1860. Leader in the Cumberland Presbyterian body, prof. in Ky. and Tenn.

Beard, WILLIAM HOLBROOK, b. 1825. American animal painter. N. A., 1862; *Humor in Animals*, 1885.

Beard-Grass. Of the genera *Andropogon*, *Polypogon*, etc., having long awns, or tufts of hair-like attachments to the flowers.

Beardsley, SAMUEL, LL.D., 1790–1860. M.C. 1831–36, 1843–45; N.Y. Supreme Court judge 1844, chief justice 1847.

Beard-Tongue. Plants of the genus *Pentstemon*, of the Figwort family, especially abundant in w. U. S.

Bear-Grass. Plants of the genus *Yucca*, natural family *Liliaceæ*, bearing large, white flowers and rigid, narrow leaves, natives of south-temperate and tropical N. America. Also called Spanish-Bayonet.

Bearing. Direction of a line as given by the magnetic needle; thus N. 30° E. is the bearing of a line which runs 30 degrees eastward of the magnetic north. A true bearing is that with reference to an astronomical meridian, this rarely agreeing with the magnetic bearing on account of the declination of the needle.

Bearing-Pile. Pile driven for the purpose of supporting a load upon its top; usually held in position by the friction and adhesion of the earth on its sides. The safe-bearing load of such a pile may be computed from the weight of the driving-ram and the amount of penetration caused by the last blow.

Bearings. Surfaces of contact between the moving pieces of a machine and the frame or primary piece which controls their motion. In rotating pieces, these must be surfaces of revolution, cylinders or cones. The bearings must be so proportioned as to allow only the motion intended; if not, "lost motion" takes place there. Collars are enlargements of diameter in a rotating piece to prevent end motion in the bearing. A thrust-box is a special form of bearing used where a rotating shaft is exposed also to a great end pressure, as in the propeller-shaft of a steamer. The shaft has a number of collars, which fit into grooves or rings in the bearing. A step bearing is one used to steady and support the lower end of a heavy upright shaft. It is also called a foot-step. The Schiele curve is often given to bearings at the ends of thrust-shafts. The bearing of a shaft is usually made of a softer material than the shaft which turns in it. The bearing can usually be more cheaply renewed than the shaft.

Bearing Surface. Area of contact of two parts of a machine, one of which moves upon the other. It must be so proportioned that the pressure per sq. inch shall not exceed a certain value which experience has shown suitable for each material, nor in lubricated surfaces must it reach a point at which the lubricating material would be squeezed out from between the contact surfaces.

Bearn. Former province in s. w. France, part of ancient Aquitania; long ruled by its own dukes; birthplace and inheritance of Henry IV. of France; incorporated with France 1620.

Bear's-Ear. *Primula Auricula.* One of the Primroses, and also for *Saxifraga sarmentosa*, an evergreen herb, native of China, but widely cultivated.

Bears. See BULLS AND BEARS.

Beast Fables. Beast stories, or fables concerning beasts, are quite universal. There have been several successive stages of religious development among all the older races. There is reason to believe that the earliest phase of man's worship or religion was one in which almost everything, animate and inanimate alike, was held to have associated with it a spiritual and potent existence. The stage of belief or religious development immediately succeeding this, and characteristic of nearly all primitive people, historic and modern alike, was that of animism or zootheism, the worship of animals as deities or symbols of deities; hence in all the older legends, not only of primitive, but also of civilized people, in much of the so-called folklore, of which so many hundreds of volumes have been collected, beast stories by far outnumber all others. Hence a study of the beast-lore contained in the folklore of our own people, the Germans and other civilized races, is of great scientific interest, since it indicates, as do so many other things, that the course of development in these highest of civilized cultures, has not substantially differed from that which may be observed as still going on with other less developed races, like various savage tribes the world over.

Beat. Stroke of the baton or hand (in ancient times the sandaled foot) by which the leader or conductor of an orchestra or chorus marks the time.

Beatification. Declaration by the Pope that a person, dead at least fifty years (unless a martyr), is "blessed"; a step toward canonization.

Beating to Windward. Making progress against the direction of the wind by steering alternately close-hauled on the starboard and larboard tacks.

Beaton, DAVID, 1494–1546. Scottish Lord Privy Seal 1528; cardinal 1538; Abp. of St. Andrew's and primate 1539; chancellor 1543; persecutor of Protestants; slain by conspirators.

Beatrice. Capital of Gage co., Neb. Pop., 1890, 13,836.

Beatricea. Long cylindrical fossil once assigned to the Cephalopods, but now believed to be allied to the sponges; found in the Trenton and Hudson R. formations.

Beats. When two musical notes differing slightly in pitch are sounded together, the effect upon the ear is an alternation of loud sound with comparative silence. If sufficiently slow, the interval between these beats may be determined with considerable accuracy. It may be shown that if N be the number of beats per second, and n and n' be the vibration frequencies of the two notes, then

$$N = n - n'.$$

We have thus an easy method not only of detecting a difference of pitch in two notes, but of determining what that difference is.

Beattie, JAMES, 1735–1803. Scottish poet and philosopher; prof. Aberdeen from 1760. *Essay on Truth*, 1770; *The Minstrel*, 1771-74; *Evidences*, 1786; *Moral Science*, 1790–93.

Beauharnais, EUGENE DE, 1781–1824. Son of Josephine, afterward wife of Napoleon I.; Viceroy of Italy 1805–14. He served with distinction in the Austrian and Russian campaigns 1809–12, and at Lützen 1813, and was made Duke of Leuchtenberg by his wife's father, the king of Bavaria.

Beaumarchais, PIERRE AUGUSTIN CARON DE, 1732–1799. French dramatist, exiled during the Revolution; author of *Memoirs*, 1774–78; *My Six Epochs*, 1793; and of the famous *Barber of Seville*, 1775, and *Marriage of Figaro*, 1784.

Beaumé, ANTOINE, 1728–1804. French industrial chemist. *Manual of Chemistry*, 1763.

Beaumé's Scale. Empirical scale of reference, to be used in determining the density of liquids by the HYDROMETER (q.v.). For liquids heavier than water, water at 17.5° C. is zero; with 10 per cent common salt, same temperature, =10° B.; for liquids lighter than water, with 10 per cent salt, 12.5° C. is zero; water, same temperature, —10° B.

Beaumont. Village of n. e. France, near Sedan; scene of a French defeat by the Germans, Aug. 30, 1870.

Beaumont, FRANCIS, 1584–1616. English dramatist who wrote jointly with JOHN FLETCHER (q.v.).

Beaumont, GUSTAVE DE LA BONNINIERE DE, 1802–1866. French penologist and official. *Marie*, 1835; *Ireland*, 1839.

Beaumont, JEAN BAPTISTE ELIE DE, 1798–1874. French geologist, known chiefly for his theory, long abandoned, in regard to the origin of mountain-chains. He regarded all parallel ranges as contemporaneous in origin, and taught that the upheaval of each system had been productive of cataclysms involving total destruction of organic life, and followed by a new creation.

Beaumont, JOSEPH, D.D., 1615–1699. Master of Peterhouse, Cambridge, and author of *Psyche*, 1648, the longest English poem.

Beaune-la-Rolande. In France, n. e. of Orleans. Scene of a French defeat by the Germans, Nov. 28, 1870.

Beauregard, PIERRE GUSTAVE TOUTANT, U. S. A. and C. S. A., 1818–1893. He served in the Mexican war and in coast-defenses, became a Confederate general 1861, and held command at Bull Run, Shiloh, Corinth, Charleston, and in Va. and Ga. He declined high offers from Roumania and Egypt 1866–69, and in his later years was an officer of the La. Lottery.

Beaurepaire, GUERNAY DE. Procureur-Général of France; novelist. *The Woodman*, 1892.

Beausobre, ISAAC DE, 1659–1738. French Protestant, exiled 1685, and pastor in Berlin from 1695; translator with Lenfant of N. T. 1718; historian of Manicheism 1734–39, and of the Reformation 1785–86.

Beaver. *Castor fiber.* Largest existing Rodent. Its tail is nearly a foot long, and the body two feet. It may attain a weight of over 50 lbs. The dense fur is water-proof, and is replaced by scales on the tail, which is flattened, almost trowel-shaped. There are 32 molar teeth, and they grow for a long time. There is a sagittal crest on the skull, and (unlike the squirrels), there are no postorbital processes. The hind feet are webbed. A cloaca is present and remarkable scent glands that yield castoreum. The salivary glands are also remarkably

large. Once the Beaver inhabited all the wooded parts of the northern hemisphere, but is now become almost extinct where civilization has established itself. In the U. S. it is still abundant on the upper Missouri and adjacent regions. It gnaws

Beaver.

trees down for food and for material to build with. Stories of its sagacity are greatly exaggerated. A fossil beaver (*Castoroides ohioensis*) was first described in 1837; it is as large as the Black Bear. See SCIUROMORPHA.

Beaver Poison. *Cicuta maculata.* N. American plant of the Carrot family, growing in swamps; known also as Water Hemlock, Spotted Cowbane, and Musquash Root.

Bebber, WILHELM JAKOB VAN, Ph.D., b. 1841. Assistant of the Seewarte, Hamburg; writer on *Meteorology* and *Climatology.*

Bebel, FERDINAND AUGUST, b. 1840. Editor of *Vorwärts,* active in the socialistic movement, and long a member of the Reichsrath. *Peasant War,* 1876.

Bebel, HEINRICH, 1472–1518. German poet-laureate 1501, prof. at Tübingen 1497; compiler of *Proverbia Germanica* and *Facetiæ.*

Beccaria-Bonesana, CESARE, MARQUESE DE, 1735–1794. Italian penologist, prof. at Milan 1768. His *Crimes and Punishments,* 1764, exerted much influence.

Beche, SIR HENRY DE LA, 1796–1855. English geologist. His geological map of England laid the foundation of the Geol. Survey and of the Geol. Museum of the British Isles, at the head of which he was placed.

Bêche-de-mer. See TREPANG.

Bechman, GEORGES, b. 1848. French engineer; designed the water supply for Paris, to be taken from the Eure; also constructed illuminating fountains of the Paris Exposition, 1889.

Bechuana. Largest of the Bantu tribes, occupying the territory between the Orange R. and the Zambesi of s.e. Africa. They include 23 sub-tribes, the most important being the Suto or Basuto, a modern confederation of several. The Boers occupy the coast region, the Kalihari desert and Lake Ngami lying to the west. In the north the Matabele, a Kafir tribe, has pushed into this territory. The B. are weak and ugly; the complexion is a clear copper-brown. They revere magic, and were once hunters and cannibals. Ab. 175,000 are under British protection. Their huts are circular, surrounded by palisades, and the children build about the paternal home. European houses are now introduced for the wealthy in the cities. None go naked, although the ancient full dress was limited to the loin cloth. The women are heavily laden with ornaments. Snuff is taken in excess. A little agriculture, but especially herding, is practiced. They enjoy dances accompanied by music. Children who cut their upper teeth first are killed, and boys are circumcised on attaining maturity. The father buys a wife for his son. At death the corpse is buried in a sitting posture, wrapped in a skin. Rain is conjured for by elaborate rites. These people adopt civilization readily and are making great advances.

Beck, CHRISTIAN DANIEL, 1756–1832. German scholar, ed. of Euripides and other Greek and Latin authors.

Beck, JOHANN H., b. 1856. American musical composer. *Skirnismal,* a symphony; overture to Byron's *Lara; Sextet for Strings.*

Beck, LEWIS CALEB, M.D., 1798–1853. Prof. Rutgers Col. 1830–37; and Albany Med. Col. from 1841. *Botany of U. S. n. of Va.,* 1833–51; *Report on Mineralogy of N. Y.,* 1842.

Becker, JOHANN JOACHIM, 1635–1682. German alchemist and chemist. He taught that when a substance burned, or when a metal was calcined, the combustible principle, "terra pinguis," escaped. This idea led Stahl to originate his Phlogiston theory.

Becker, MAX J., b. 1827. Chief engineer of Pittsburg, Cincinnati and St. Louis R.R. from 1867; pres. Am. Society of Civil Engineers 1889

Becker, WILHELM ADOLF, 1796–1846. German archæologist; prof. Leipzig 1842. His *Gallus,* 1838, and *Charicles,* 1840, are much less romances than learned collections of everything that could illustrate ancient Roman and Greek manners. *Roman Antiquities,* 1843–46.

Becket, THOMAS A, 1118–1170. Chancellor of England 1155; Abp. of Canterbury 1162; murdered, after seven years of strife with Henry II., in his own cathedral 1170; canonized 1173.

Beckett, GILBERT ABBOTT A, 1811–1856. English humorist. *Comic History of England,* 1848.

Beckford, WILLIAM, 1759–1844. English author of great wealth; M.P. 1790. His residence, Fonthill Abbey, was sold 1822 for £330,000. His famous oriental romance, *Vatkek,* 1784, was written in French, and tr. by another hand. *Italy,* 1834; *Extraordinary Painters,* 1835.

Beckwith, JAMES CARROLL, b. 1852. American portrait and figure painter; pupil of Carolus Duran.

Beckx, PIERRE JEAN, 1795–1887. General of the Society of Jesus 1853; retired 1883.

Becquer, GUSTAVO ADOLFO, 1836–1870. Spanish novelist.

Becquerel, ANTOINE CESAR, 1788–1878. Member Acad. Sci. in Paris 1829; authority on atmospheric electricity, earth currents, and terrestrial magnetism. *Electricity and Magnetism,* 7 vols., 1834–40; *Terrestrial Physics and Meteorology,* 1847.—His son, ALEXANDRE EDMOND, 1820–1891, became prof. in Paris 1853, and wrote on *Light,* on the *Temperature of the Soil,* and the *Magnetic Power of Oxygen.*

Bed. Mineral stratum conformable in position and cotemporaneous in origin with the inclosing rocks.

Bed-Bug. Hemipterous insect of the family *Cimicidæ, Acanthia lectularia.* Found in beds, crevices, and on animals, particularly bats.

Beddoes, THOMAS, M.D., 1760–1808. English author. *Isaac Jenkins,* 1793; *Hygeia,* 1801–2.

Beddoes, THOMAS LOVELL, 1803–1849. English poet; son of Dr. Thomas and nephew of Maria Edgeworth. *The Bride's Tragedy,* 1822; *Works* (posthumous), 1851; *Political Works,* 1890; *Letters,* 1894.

Beddome, BENJAMIN, 1717–1795. English Baptist divine. Of his 830 hymns, pub. 1817, many are still in use.

Bede, CUTHBERT. See BRADLEY, EDWARD.

Bede, THE VENERABLE, 674–735. English Benedictine monk. His *Ecclesiastical History* extends to 731; tr. 1844 and 1870.

Bedell, GREGORY THURSTON, D.D., 1817–1892. P. E. Bp. of Ohio 1859–89. He and his father, GREGORY TOWNSEND, D.D., 1793–1834, were popular religious writers.

Bedell, WILLIAM, 1571–1642. Bp. of Kilmore and Ardagh, in Ireland, 1629; promoter of the Irish tr. N. Testament.

Bedlam. Priory of St. Mary of Bethlehem in London, converted into a lunatic asylum 1547; succeeded by a hospital at Moorfields, built 1675, demolished 1814. The present hospital, in St. George's Fields, was opened 1815.

Bed, MORTAR. Timber platform on which mortars are placed for firing. In modern sea-coast defense the mortars are rifled 12-in. guns, the body of cast-iron and hooped with steel jackets, and as their weight is ab. 14 tons each, the beds are more solidly constructed with masonry than formerly.

Bedouins. Nomadic Arabs, of Arabia, Syria, Algeria, and adjacent regions. In Arabia, they form but a sixth part of the population. They are herdsmen, dwellers in tents, and live on the margin of the steppes. They are white to chocolate-colored, dress simply, the children going naked before puberty, and in physique they are models. They profess Mohammedanism, but do not observe its tenets strictly. They are under no government, and are in a fashion judged by the chief, patriarch, or

Bedouin.

sheykh of each tribe. They are illiterate, and rob travelers, or even caravans of different tribes, when they have not given their promises of safety, which can be purchased, with guides, as a sort of passport. The most important tribe, the one trading in horses, etc., with foreigners, is the Anezah clan of s. Syria and n. Arabia. This is best armed, but their guns are match-locks, and though good marksmen they rely on the dagger. Marriageties are rather loosely observed, but the women are better loved than those of the city Arabs.

Bed-Plates. In an engine, or machine, that part of the casting to which the bearing-surfaces of the moving parts are secured, and which in an engine resists the tendency of the cylinder to be displaced by the reaction of the driving fluid. In a vertical beam engine, such as is used in vessels, it is called the sole-plate, and is made hollow to carry the foot-valve between the condenser and air-pump. In stationary engines it is fastened by long bolts to the foundation, to prevent any displacement of the main shaft, due to lack of balance of the revolving or reciprocating parts.

Bed-Rock. Underlying a placerdeposit; term in common use among California miners.

Beds, ANCIENT. Modern beds can be traced to Roman antiquity. There are three of the couch form in the Naples Museum, from Pompeii, mainly of bronze. There is a bronze bedstead in the Etruscan Museum of the Vatican, with strips of metal to support the mattress, similar to those now in use. The bed of Oriental countries is generally a mat or rug, but in India a raised wooden bed is in native use.

Bed-Sores. Ulceration or abscess due to long-continued lying in bed. In severe illness it may end fatally or retard recovery. They are easily prevented by bathing the back, the part usually affected, with alcohol, avoiding creases in the bedclothing, and preserving perfect cleanliness.

Bedstraw. Species of the genus *Galium*, natural family *Rubiaceæ*.

Bee. See APIDÆ.

Beech. Trees of genus *Fagus*, the European and Asiatic Beech being *F. sylvatica*, and the N. American *F. atropunicea*. Their wood is used to a limited extent in making furniture. Other species exist in Terra del Fuego and Australasia.

Beech, BLUE. In N. America the Hornbeam, *Carpinus Caroliniana*.

Beech, WATER. See HORNBEAM.

Beech-Drops. Small parasitic plant, *Epiphegus Virginiana*, which grows on the roots of the American Beech.

Beech-Drops, FALSE. See PINE-SAP.

Beecher, EDWARD, D.D., b. 1803. Eldest son of Dr. Lyman; pres. Illinois Col. 1830–44; ed. *Congregationalist*, 1849–53. *Baptism*, 1849; *Conflict of Ages*, 1853.—His brother, CHARLES, b. 1815, is also an author.—Another brother, THOMAS KENNICOTT, b. 1824, pastor at Elmira, N. Y., since 1854, wrote *Our Seven Churches*, 1870.—Their elder sister, CATHERINE ESTHER, 1800–1878, was a teacher and prolific writer.

Beecher, HENRY WARD, 1813–1887. Son of Dr. Lyman; pastor of Plymouth Ch., Brooklyn, from 1847; considered the greatest preacher in America; founder of the *Christian Union*, 1870. *Star Papers*, 1855; *Life Thoughts*, 1858; *Royal Truths*, 1864; *Norwood*, 1864. His printed sermons had an immense circulation.

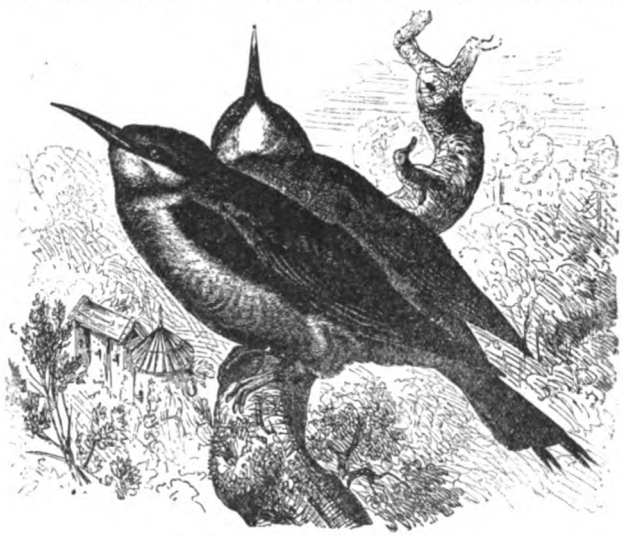
Beecher, LYMAN, D.D., 1775–1863. Pres. Lane Theol. Sem., Cincinnati, 1832–51. Eminent himself, and father of a numerous and eminent family. His trial for heresy in 1835, with that of Albert Barnes, led to the division of the Presbyterian Church. *Views on Theology; Autobiography.*

Beechey, FREDERICK WILLIAM, 1796–1856. English navigator, noted for Arctic and African explorations; rear-admiral 1854.

Beech-Fern. *Phegopteris Dryopteris.* Small wood-fern of the northern hemisphere.

Beech-Wood. Compressive strength ab. 7,000, tensile strength ab. 11,000 lbs. per sq. in. of cross-section.

Bee-Eater. *Meropidæ.* Old World tropical birds of bright plumage. They swallow bees and wasps whole without injury, though these sting other birds to death. They nest in colonies



Bee-eater (*Merops apiaster*).

in deep tunnels on sandy banks. They have the outer and middle toes united to the last joint. In *Merops* the lower parts are bright-blue, the throat yellow, rump rufous, and the back chestnut. See LEVIROSTRES and CUCULI.

Beef. Flesh of cattle; that of bullocks of ab. 3 years old is the most desirable. It stands next to pork in nutritive value, but is preferable on account of its readier digestibility. The proportion of bone should not exceed 20 per cent; the fat firm and neither too yellow nor too white; the muscular tissue should be of a bright, clear red. It should not lose more than one-third or one-half its wt. in cooking, according as it is lean or fat. The time usually occupied in its digestion is ab. 3 hours.

Bee-Hive Tombs. Constructed by gradually-projecting stones, laid one above the other until the roof was completed in the form of a dome, but without the arch principle and keystone. It was used in portions of the CHAMBERED BARROWS (q.v.), but the most carefully constructed tombs of this class were those of the Mycenæ culture of ancient Greece. The Treasury of Atreus at Mycenæ is a tomb of this class.

Beelzebub. Originally Beëlzebul, changed by a species of Hebrew pun to Baalzebub, signifying "Lord of Flies" or "Lord of Dung." B. was the local god of Ekron, Philistia, and came to be used in the N. T. as the chief of all the devils.

Bee-Martin. Kingbird (*Tyrannus tyrannus*). A shrike-like bird, over 8 in. long, blackish ash in color, white below; tail black and white-tipped. It can erect the feathers on its head, showing orange bases of quills, so that insects are attracted toward it, especially bees, which it snaps up. Some authorities think this bright crown spot so displayed has only a sexual significance. It eats insects, and during the breeding season darts at any birds, such as hawks, that approach the nest, and drives them away by its thrusts and cries. It lays five or six salmon-colored eggs, spotted with brown, purple, and orange in a zone near the larger end.

Beer. Under this title is included ale, beer, porter, and stout, which are alcoholic beverages, made from barley MALT (q.v.) and hops, and called malt liquors. The use of drinks made from fermented grain dates from the ancient Egyptians. They are now used throughout the world, and the consumption has largely increased of late years. In the brewing of lager beer, the malt is crushed, and steeped in a covered mash tun, with a perforated false bottom, in warm water, which is gradually raised by steam to 167° F.; this dissolves the soluble constituents and, by means of the diastase in the malt, the starch of the malt is converted into dextrine and malt sugar, requiring about two hours. The extract or "wort" is strained through the false bottom, and the refuse, after washing out all of the extract, is sold for feed to farmers, under the name of "brewers' grains." The wort is now boiled in a closed copper mash kettle, with addition of hops, in four portions, the boiling lasting from four to six hours. It is then filtered through a "hop jack," and rapidly cooled by exposure to the air in shallow tanks and subsequent running over a series of copper tubes, through which cold brine flows, or into which liquid ammonia is allowed to expand. The wort now goes to the fermentation tuns, where the yeast is added and the sugar converted into alcohol. The temperature of the fermenting cellars is ab. 40° F., and the amount of yeast is 1 qt. to every 4 bbls. of wort. In 40 hours the fermentation is well under way, and it is completed in 12 to 14 days. The yeast settles and the beer is run to cleansing butts, where the remaining yeast works out the bung holes by slow fermentation. It is then transferred to storage tanks, where it remains from 4 to 6 months. For summer beer there are used 3 bush. malt and 1½ to 3 lbs. hops per bbl. of beer and it is "lagered" or stored from 4 to 6 months; for "Schenck" or winter beer, 2 to 3 bush. malt, 1 lb. hops, and 4 to 6 weeks' storage; and for "Bock" beer, 3½ bush. malt, 1 lb. hops, and 2 months' storage. Other malt liquors are made in a similar manner; for ale, pale malt is used and the temperature of fermentation is higher, ab. 60° F. For porter and stout, amber or brown malt is used. In manufacture of beer, from the malt is produced the alcohol, dextrine, sugar, and other extractive matters and the carbonic acid which renders the beer effervescing; and the hops clarify the beer by precipitating the albuminous substances by means of the tannic acid they contain, and also increase the durability; they give the bitter flavor and have a tonic and stimulating effect upon the consumer. The strength of beers is as follows:

	Alcohol, per cent.	Solid matter.
Bass' Barley Wine	8.41	11.75
Allsopp's Ale	8.25	13.32
Guinness' Stout	6.81	6.17
Hanbury's Porter	4.02	5.12
Munich Lager	4.70	6.10
" Schenck	3.90	5.70
" Bock	4.60	9.20
American Lager	4.25	5.75

An analysis of American lager gave the following composition: alcohol 4.25, solids 5.75, and water 90. The solids consisted of malt sugar 1.42, dextrine 2.68, albuminoids 0.60, lactic acid 0.15, phosphoric acid 0.09, and ash 0.30.

All beers should be made from barley malt and hops, but when not prevented by law, other substances are substituted for the purpose of reducing the cost. Other malted or unmalted grains, starch and glucose may be used in place of barley malt, and it is claimed that other bitter substances are used instead of hops. In the U. S. bicarbonate of soda is generally added to the beer in kegs, to render the beer alkaline and to increase effervescence; and salicylic acid is added sometimes to bottled beer to increase its endurance.

The increase in consumption of malt liquors in U. S. is shown by the following statement in gallons:

	Malt Liquors.	Per Capita.	Spirits.
1860	101,346,699	3.22	2.86
1870	204,756,156	5.30	2.07
1880	414,220,165	8.26	1.26
1893	1,024,713,096	14.85	1.36

When free from adulteration and an excess of starchy bodies beer is a desirable beverage in convalescence from disease, nursing, and all conditions in which a person is debilitated.

Beer Money. Daily allowance granted 1800 to British soldiers, in addition to their pay, as a substitute for an allowance of beer or spirits. Such allowance has also been given to domestic servants in England.

Beers, HENRY AUGUSTIN, b. 1847. Prof. at Yale since 1875; poet, and biographer of N. P. Willis, 1885.

Beersheba. Place in the extreme south of Judæa, named from Seven Wells still there; abode of Abraham and Isaac, and, in his youth, of Jacob. Dan being the extreme north of Palestine, "from Dan to Beersheba" became an idiomatic phrase.

Bees. See APIDÆ and APIS MELLIFICA.

Beeswax. Mpt. 64°–65°; Sp. gr. .969. Secreted by bees. It consists mainly of myricic palmitate, $C_{16}H_{31}(C_{30}H_{61})O_2$, cerotic acid, $C_{27}H_{54}O_2$, cerolein, and several hydrocarbons. Soluble in chloroform, less soluble in alcohol and ether. In heating it yields acetic and proprionic acids, carbon dioxide, ethylene, a thick white oil, and a non-volatile residue. Bleached by sunlight under water. Used for candles, electrotype molds, models, etc.

Beet. *Beta vulgaris.* Thick-rooted herb of the natural family *Chenopodiaceæ*, native of the Old World; supposed to have been derived by cultivation from *B. maritima*, a common European seaside plant. Raised in field culture as food for stock and for making sugar. They should be planted in driills, two and a half feet apart, in deep rich friable soil that has not received stable manure within a year, as early in spring as the land can be brought in good tilth. They are usually sown much too late. Culture must be clean and frequent throughout the season. Sugar beets should be planted thickly, so as not to reach a weight of more than 2 or 3 lbs. Many varieties of both sugar beets and mangels are grown. The latter are used exclusively for stock feeding. It has been proven experimentally that sugar beets, containing enough sugar for profitable manufacture, can be grown throughout a very large portion of the n. U. S., and several factories have been in successful operation for some years; but the expensive machinery required and the high price of labor in cultivation have hitherto operated against the rapid spread of raising beets for sugar.

Common Beet.

Beet, JOSEPH AGAR, D.D., b. 1840. English N. T. commentator, prof. Wesleyan Theol. Col. 1885. *Holiness*, 1880; *Through Christ to God*, 1892.

Beethoven, LUDWIG VAN, 1770–1827. One of the greatest of composers; perfector of the symphony and sonata, who brought the classic style of composition to its highest point of development, and opened the way in all departments to the Romantic School now dominant; b. in Bonn, where his father and grandfather were musicians in the service of the Abp. and Elector of Cologne. His ancestry was Dutch, and the "van" in his family name is not a sign of nobility like the German "von." Hard study and ill treatment marked his childhood, and though at 13 he had pub. six sonatas for the piano, he dated his productive career from 1795, when he dedicated three Trios, his first numbered work, to Haydn, his teacher for a time in Vienna, whither he was sent for instruction in 1792 by the Elector Max Franz. There Mozart had heard him play in 1787, and predicted his future greatness. When his patron died in 1801, he resolved to remain in Vienna. He was impracticable in business affairs, and a predisposition for solitude and hatred of social conventions, intensified by deafness, which overtook him in 1812, made his life unhappy. So highly was his genius esteemed that a few nobles established a fund for his maintenance, though his democratic opinions were shown by his *Sinfonia Ervica* in honor of Napoleon, and his destroying the title page with the dedication when Bonaparte became emperor. His compositions include nearly all kinds of music. He wrote nine symphonies, one opera, five pianoforte concertos, sixteen string quartets, four quintets, one sextet, one septet, eight trios, thirty-eight pianoforte sonatas, ten violin sonatas, five violoncello sonatas, one horn sonata, two masses, one oratorio, besides overtures and between-acts music for several dramas, many songs, etc. His earlier works, including his first two symphonies, are modeled after those of Haydn and Mozart; beginning with the third (*Heroic*) symphony, his individuality asserts itself, the established forms are respected, but freely extended for the sake of the poetical contents, as in the fifth and sixth (*Pastoral*) symphonies; the works of his last decade, largely influenced by the introspection compelled by his deafness, show entire emancipation from formal restrictions, as the solemn mass in D, the ninth symphony with choral finale, the last sonatas and quartets, which still stand isolated in musical literature. His most widely known works are *Symphony Ervica* (third), 1806; *Fidelio*, 1810; *Symphony No. IV.*, 1808; *Overture to Coriolan*, 1808; *Mass in C*, 1812; *Symphony No. V.*, 1809; *Symphony No. VI.*, 1810; *Pianoforte Concerto in E-flat*, 1810; *Music to Egmont*, 1811–12; *Symphony No. VII.*, 1816; *Symphony No. VIII.*, 1816; *Missa Solemnis*, 1827; *Symphony No. IX.*, 1826.

Beetle. See COLEOPTERA.

Beets, NICOLAUS, b. 1814. Dutch poet and critic; prof. theol. Univ. Utrecht 1875. *Camera Obscura* (prose), 1839.

Beet Sugar. See SUGAR and BEET.

Beggars, NEW. Walloon garrisons in the army of Prince Maurice. They contributed materially to his victory at Nieuport, July 2, 1600.

Beggars' Lice. *Lappula Virginiana.* Plant of the natural family *Boraginaceæ*, native of N. America.

Beggars of the Sea. Privateersmen, mainly Zealanders, commissioned by William of Orange to cruise against the Spanish trading ships in the war of liberation. They captured Brill April 1, 1572, and relieved Leyden Oct. 3, 1574.

Beggars'-Ticks. Certain species of the genus *Bidens*, of the natural family *Compositæ;* natives of N. America.

Bidens cernua.

Beghards, or BEGUINES. Religious societies, at first of women, afterward of men, originating in the Low Countries ab. 1180, continuing till ab. 1550, and in a few cases still extant. Many of the Beghards became mendicants, and some were persecuted as heretics.

Beginning of the Day. The day is understood as beginning at the 180th meridian from Greenwich. It is the custom of navigators when crossing the Pacific to change the date at this line. In sailing, *e.g.*, from San Francisco for a Chinese port, if this meridian were reached July 4th, the next day would be called July 6th. If coming from China to San Francisco, the following day would again be July 4th.

Beginning of the Year. In England previous to 1752 the legal year began March 25th. With the adoption of the Gregorian Calendar the date was changed to Jan. 1st.

Begonia. Large and curious genus of herbaceous plants,

Begonia Rex.

natural family *Begoniaceæ;* extensively cultivated for their showy leaves and flowers; natives of tropical America and Asia.

Begoniaceæ. Natural order of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledones*, comprising 3 genera and ab. 420 species, distributed through the tropical regions of both hemispheres.

Behaim, MARTIN, ab.1436–1509. German trader, traveler, and cartographer. A globe which he made ab. 1492 is preserved at Nuremberg.

Behaim, MICHAEL, 1416–1474. German poet.

Behar. Capital of a district in Bengal. Pop. ab. 50,000.

Behemoth. Idealization, Job xl. 15–24, of the Hippopotamus, as the type of animal strength and courage.

Behistun. Site of an ancient Persian city; famed for the rock inscription dating from Darius Hystapes, 518 B.C., in cuneiform writing, Persian, Median, and Babylonian.

Behm, ERNST, 1830–1884. German geographer and statistician.

Behm, or BEHEMB, MARTIN, 1557–1622. German hymnist.

Behn, MRS. APHRA (JOHNSON, "ASTRÆA"), 1640–1689. English dramatist, novelist, and poet, noted chiefly for the indecency of her writings. *Orinokoo.*

Behring. See BERING.

Being. In common usage, an individual organic creature. —In philosophic parlance, anything that exists, substance or accident, matter or mind.

Beissel, CONRAD JOHANN, 1690–1768. Founder and head of the monastic community of Seventh-Day Dunkards at Ephrata, Pa.; author of 441 German hymns. *Theosophical Letters*, 1745; *Theosophical Sermons*, 1752.

Beke, CHARLES TILSTONE, Ph.D., 1800–1874. English explorer. *Origines Biblicæ*, 1834; *Sources of the Nile*, 1848; *Discoveries of Sinai*, 1878.

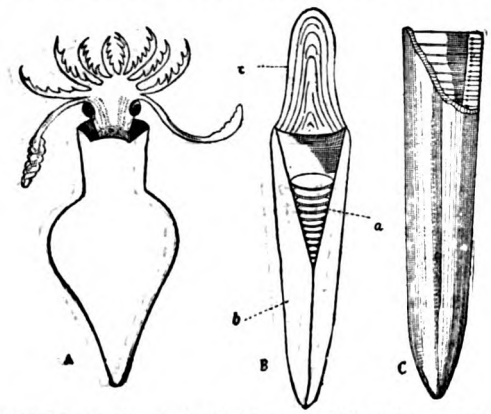
Bekker, AUGUST IMMANUEL, 1785–1871. Prof. Berlin 1810; ed. Plato, Aristotle, and other Greek authors.

Bekker, BALTHASAR, 1634–1698. Dutch reformer, excommunicated for exposing popular errors in *The World Bewitched*, 1691–93.

Bel, or **Belus.** Supreme male divinity of the Assyrians and Babylonians, shaper of heaven and earth, creator of men and animals; a higher conception than the BAAL of the Syrians and Phœnicians. The Temple of B. was a vast structure in the city of Babylon; rebuilt by Nebuchadnezzar ab. 600 B.C.

Belcher, SIR EDWARD, R.N., 1799–1877. Rear-admiral, 1872. He circumnavigated the globe 1836-42, and commanded an unsuccessful expedition in search of Sir John Franklin 1852.

Belemnite. Internal bone of a mesozoic squid; cylindrical, with conical end and a hollow chambered base; often called



A, Animal restored. B, Its skeleton. C, *Belemnites canaliculatus.* a, phragmacone; b, guard; c, horny "pen."

"thunderbolts" by quarrymen, supposed to be homologous with the pen of the decapodous *Cephalopods.*

Belfast. Chief commercial and manufacturing city of Ireland, at mouth of R. Lagan, chartered 1611. Pop. 1891, 255,896.

Belfort. Town of e. France, s. of the Vosges Mts. and near the border of Alsace; taken by the Germans Feb. 16, 1871, after seven weeks' siege. Pop., 1891, 83,670.

Belfry. Tower containing a vault built to contain a bell or bells, applied to the whole structure, as well as to the compartment containing the bells, which is known specifically as the belfry-stage.

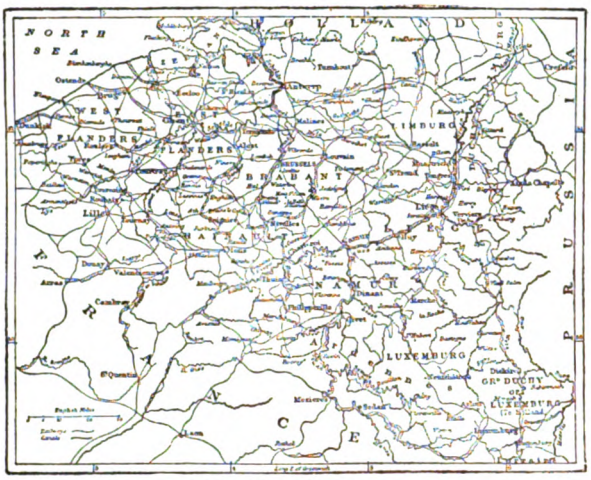
Belgæ. German tribe in n. e. Gaul between the Rhine and the Seine; conquered by Cæsar 51 B.C.

Belgian Pavement. Stone pavement formed of blocks of trap rock nearly cubical in shape, or from 4 to 6 in. on each edge. These are closely laid on a concrete foundation, the courses running across the street. It is good for heavy traffic, but the blocks are liable to become smooth under wear; hence granite is now more extensively used. In New York 200 m. of streets have been paved with Belgian blocks at a cost of $2.50 per sq. yard.

Belgiojoso, CRISTINA (TRIVULZIO), PRINCESS, 1808–1871. Italian author and patriot, exiled 1830 and 1850, and living many years in Paris. *Formation of Catholic Dogma*, 1846; *Reminiscences of Exile*, 1850; *Asia Minor and Syria*, 1858; *House of Savoy*, 1861; *State of Italy*, 1869.

Belgium. Kingdom of w. Europe. Its area is 11,373 sq. m. The surface is level, except in the s. e. part, where it rises into hills. Pop., 1892, 6,195,355, an average of 540 inhabitants to a sq. m.; it is the most thickly settled country in the world. Its agricultural industry is surprisingly large when the density of the population is considered. It has extensive manufactures, particularly of woolens, cottons, linens and silks, iron and steel. It is a network of railroads and canals. Of the former there were in operation, in 1891, 2,830 m. Its exports amount to $610,000,000. Brussels is the capital. In Roman times, the Belgic territory was occupied by Celts and Germans; the Franks entered in 5th and 6th centuries. Under the Feudal System, duchies and counties arose, Flanders being the chief. The house of Burgundy gained possession of the Netherlands, 1385–1420. Under Philip II. of Spain, heir of this house, a war for civil and religious freedom arose, ending in the independence of the northern provinces; the southern remained subject to Spain. Large portions were ceded to France 1659–97. At

the peace of Utrecht, 1713, B. was given to Austria. It was conquered by France 1794, united with Holland 1814–30, and since 1835 has been a kingdom. It now has universal suffrage, qualified by plural voting. All male Belgians above the age of



Sketch Map of Belgium.

twenty-five have a vote; married men and widowers, paying at least 5 francs ($1) house-taxes, have two votes on reaching their thirty-sixth year. Men with a college education and priests have three votes. This makes the 10,000 priests in B. an element of great political importance.

Belgrade. Capital of Servia, at junction of Save and Danube. It repelled the Turks 1456; was taken by Solyman II. 1521, by the Elector of Bavaria 1688, and recovered by Turks 1690.

Belgrade.

Prince Eugene besieged it May, 1716, and defeated a large Turkish army Aug. 16, 1717. From 1739 it was held mostly by Turkey, till Servia became independent 1878. Pop., 1891, 54,458.

Belgrade, TREATY OF, Sept. 1, 1739. Austria restored to the Porte Belgrade, Orsova, and portions of Servia, Wallachia, and Bosnia, gained at Passaro. Russia received Azof, engaging to raze the fortifications, and keep no war-vessels on the Black and Azof seas.

Belgrand, EUGENE, 1810–1878. Director of the hydrology of the Seine, designer of the sewage of Paris; author of memoirs relative to the rainfall and floods of the valley of the Seine.

Belial. In O. T., personification of evil; in N. T., Satan; originally, worthlessness.

Belief. Mental assent to a statement or doctrine; sometimes equivalent to FAITH (q.v).

Belisarius, ab. 505–565. Greatest general of Byzantine empire; conqueror of the Vandals in Africa 534, and the Goths in Italy 536–540; charged with conspiracy 563 and imprisoned, but soon released. The story of his blindness and beggary is a fiction.

Belknap, JEREMY, D.D, 1744–1798. Pastor at Dover, N. H., 1767–86, and Boston; founder Mass. Historical Society 1790. *History of New Hampshire*, 3 vols., 1784–92; *American Biography*, 1794–98.

Bell. In architecture, the swelling part of a capital between the neck-molding and the abacus, whether concave or convex in outline, and excluding the foliage, volutes or other ornaments.

Bell, ALEXANDER MELVILLE, b. 1819 in Edinburgh. Elocutionist, resident in Canada 1870–81, and since in the U. S.: author of *Visible Speech*, 1867, and *Phonetics*, 1887.—His son, ALEXANDER GRAHAM, Ph.D., b. 1847, is the inventor of the telephone, 1872–76, the photophone, 1880, and the graphophone, 1887.

Bell, ANDREW, D.D., LL.D., 1753–1832. Scottish educational reformer, chaplain in India 1787–96. His "monitorial system," devised at the Madras orphanage ab. 1790, was popularized by JOSEPH LANCASTER (q.v.).—His brother, SIR CHARLES, F.R.S., 1774–1842, prof. Edinburgh 1836, was an eminent surgeon. *Anatomy of the Brain*, 1811; *Nervous System*, 1830.

Bell, CLARA, b. 1840. English translator of many novels and scientific works.

Bell, GEORGE JOSEPH, 1770–1843. Prof. Univ. Edinburgh 1822; clerk of session 1832. *Commentaries on the Laws of Scotland*, 1810; *Principles of the Law of Scotland*, 1829.

Bell, HENRY, 1767–1830. Constructor of the first European steamboat 1812.

Bell, JOHN, 1797–1869. M.C. from Tenn. 1827–41, Speaker 1834, Sec. of War 1841, U. S. Senator 1847–59, "Const. Union" candidate for President 1860.

Bell, ROBERT, 1800–1867. B. at Cork; English author; ed. *Morning Chronicle*, 1841. *History of Russia*, 1836–38; *Lives of the Poets*, 1839.

Bell, ROBERT, b. 1841. Assistant director of the Geological Survey of Canada since 1877.

Belladonna. The entire plant, *Atropa Belladonna*, possesses medicinal properties, due to the presence of an alkaloid, atropine, but the term is usually limited to the leaves and root. It is a powerful poison, causing dilatation of the pupils, dryness of the mouth and throat, slight increase of the body temperature, delirium, stupor, and death from failure of the heart and respiration. It is principally used in medicine to dilate the pupils, for sore throat, scarlet fever, whooping cough, asthma, incontinence of urine, and in the form of a plaster to relieve pain.

Belladonna (*Atropa Belladonna*).

See NIGHTSHADE, DEADLY.

Bellamy, EDWARD, b. 1850. American novelist. *Dr. Heidenhoff's Process*, 1879; *Miss Ludington's Sister*, 1884. His *Looking Backward*, 1888, started the Nationalist movement, with which he has since been identified.

Bellamy, JACOBUS, 1757–1786. Dutch poet, author of national songs.

Bellamy, JOSEPH, D.D., 1719–1790. Pastor at Bethlehem, Conn., from 1740, and father of "New England Theology." *True Religion Delineated*, 1750; *Theron, Paulinus, and Aspasia*, 1759.

Bell and Hammer. Popular game in Germany, known in France as "Jeu du Cheval Blanc." The implements consist of light dice, marked on one side with dots, from one to six, a figure of a bell and a hammer, the other sides being blank, and five cards with pictures of a white horse, an inn, a bell, a hammer, and a bell and hammer.

Bellani, ANGELO, 1776–1852. Prof. physics Univ. Pavia; author of memoirs on phenomena of evaporation, fog, hail, dew, rain, and malarial climates.

Bell-Animalcule. See VORTICELLA.

Bellarmine, ROBERT, 1542–1621. Cardinal 1599; greatest apologist of the R. C. Ch. *Controversies of the Christian Faith against Heretics*, 3 vols., 1581–92.

Bellary. Capital of a district in Madras. Pop., 1891, 59,770.

Bellay, JOACHIM DU, 1525–60. French poet.

Bell-Bird. *Chasmarrhynchus carunculata.* Allied to Cotingas; size of a jay; male, white; female, gayly colored; found in S. America. Its name comes from its note, which clangs like a tolling bell, heard 3 m. away.

Bell-Cot, BELL-GABLE, BELL-TURRET, BELL-TOWER. Erection upon a roof or tower, or projected upon corbels from a wall for the purpose of holding a bell, or bells.

Belleau, REMI, 1528–1577. French poet. *Petites Inventions*, 1557; *Bergerie*, 1565–72; *Amours*, 1576.

Bellenden, or **Ballantyne,** JOHN, ab. 1490–ab. 1550. Scottish poet and translator.

Bellenden, WILLIAM, ab. 1555–ab.1633. Scottish scholar; compiler from Cicero. *De Statu*, 1615.

Bellerophon. Son of Glaucus, king of Corinth. Antea, wife of Prœtus, king of Argos, after soliciting his love in vain, accused him to her husband, and, to compass his death, he was sent by the king of Lycia to slay the monster Chimæra, but with the aid of the winged horse Pegasus destroyed her.

Bellerophon. Extensive genus of flat fossil gasteropod shells.

Belleville. City of St. Clair co., Ill. Pop. 1890, 15,361.

Bell-Flower. *Campanula rotundifolia*, also called Harebell, and other species of the same genus, natives of the northern hemisphere.

Belli, GUISEPPE, 1791–1860. Prof. physics Univ. Pavia; author of treatise on experimental physics, and numerous memoirs on aërometry, electricity, temperature, hygrometry, etc. Inventor of the ventilated dry and wet bulb psychrometer.

Belligerency. Two sovereign powers, engaged in actual war, are called belligerents. Each is vested with all the rights and charged with all the obligations incident to a state of war. The recognition of a state of belligerency simply implies that the military operations of both contestants shall be carried on in accordance with certain accepted usages, which are sanctioned by all civilized nations, under the name of the Laws of War. But when rebellion occurs, or a colony revolts against its parent country, the case is somewhat different. The insurgents have, at first, no international standing; but as soon as the parent country decides to resort to warlike methods to suppress the rebellion or revolt, a neutral power may, by proclamation, recognize the insurgents as belligerents. Such occurred with France recognizing the belligerent rights of the Southern Confederacy in 1861. This recognition, however, does not involve the recognition of the rebellious government as a separate political organization; it only implies that the laws of war are to prevail in the military operations undertaken for the purpose of suppressing the rebellion, enforcing the laws and restoring the supremacy of the national government. It gives rights to both combatants. To the insurgent it grants the right of belligerents, the recognition of its flag, a right to raise loans, and a quasi-political status, without diplomatic standing. The parent state, on the other hand, is freed from the responsibility of the acts of its rebellious subjects; it can employ the rights of blockade, of capture for carrying contraband of war, and of search against its enemy, thus affecting neutral commerce. In short, all parties recognize that a war exists between two combatants, while the recognition of independence is another question, which is to be decided by after results growing out of the progress of the war.

Bellini, GENTILE, 1427–1507. Venetian painter, belonging to the transition period from the Archaic to the perfected Italian art. His chief interesting works are the *Miracle of the Cure* and others in the Venice Academy, a picture in the Louvre, *Receipt of a Venetian Embassy by the Grand Vizier*, and a portrait of Mahomet II., owned by Sir Henry Layard.

Bellini, GIOVANNI, 1428–1516. Most distinguished Venetian painter of the transition period, representing the evolution of Venetian art from the School of Padua. Pupil and brother-in-law of the Paduan Mantequa, whose grim and painstaking realism is reflected in his early work. Good illustrations of this style are *Christ's Agony in the Garden*, in the National Gallery, London, and the *Pieta*, in Milan. His later pictures show great beauty and lead in style to those of his pupils Giorgione and Titian.

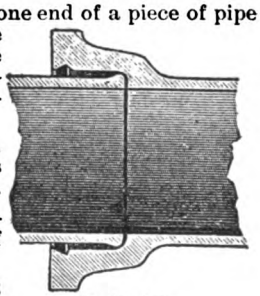
Bellini, JACOPO, 1395–1470. Venetian painter, father of GENTILE and GIOVANNI.

Bellini, VINCENZO, 1802–1835. Italian opera composer, distinguished for the tenderness and elegance of his melodies. *Adelson e Salvino*, 1824; *Bianca e Fernando*, 1826; *Il Pirata*, 1827; *La Straniera*, 1829; *Zaira*, 1829; *I Capuletti ed i Montecchi*, 1830; *La Sonnambula*, 1831; *Norma*, 1831; *Beatrice di Tenda*, 1833; *I Puritani*, 1835.

Bellite. High explosive used for cartridges or other war purposes, invented by a Swede, Carl Lamm, and is composed of 2 pts. nitrate of ammonium, and 1 pt. nitrobenzene.

Bell Isle. On s. coast of Brittany; taken by the British June 7, 1761; restored to France in 1763.

Bell Joint. Used in water-pipes, one end of a piece of pipe being slightly bell-shaped to receive the spigot end of another piece. The figure shows also the gasket placed between the bell and the spigot to prevent leakage.



Bell Joint.

Bellman, KARL MICHAEL, 1740–1795. Swedish poet of the people. His songs have had great popularity and influence.

Bell-Metal. Alloy of tin and copper, containing from 20 to 25 parts of the former to 100 of the latter.

Bell-Metal Ore. Mineral stannite; a sulphur compound of tin, copper, and iron, sometimes resembling bronze or bell-metal in appearance. Found in the tin mining district of Cornwall.

Bellona. Roman goddess of war; sister or wife of Mars.

Bellot, JOSEPH RENE, 1826–1853. French Arctic explorer, who discovered in 1852 the strait which bears his name, between Bœthia Felix and N. Somerset.

Bellows. Instrument for producing artificial draught. Known to the Orientals in the earliest times, found depicted on Egyptian monuments, and in use among most savage races.

Bellows, HENRY WHITNEY, D.D., LL.D., 1814–1882. Unitarian pastor in N. Y. from 1838; ed. *Christian Inquirer*, 1846; pres. U. S. Sanitary Commission 1862–66. *Restatement of Christian Doctrine*, 1859; *Old World in its New Face*, 1867.

Bello y Lopez, 1781–1865. Venezuelan poet, patriot, and jurist, resident in London 1810–29, and from 1829 in Chili, where he was greatly honored. His works were pub. in 8 vols. 1881–85.

Bell-rock, or INCHCAPE. Dangerous reef, 2,000 ft. long, at the mouth of the Tay, Scotland. A lighthouse now takes the place of the bell placed here to warn mariners. Famous from Southey's poem, *The Inchcape Rock*.

Bells. The origin of the bell may be directly traced to the rattle used by primitive man in religious ceremonies. All primitive worship has been by dramatic presentation in the so-called processional dances of savages, designed to present the myth and ritual concerned in the worship. Hence for the accentuation of the words and music, and for the unification of the action in these performances, rattles, the prototypes on the one hand of bells, and fringes of shells, hoofs, or other hollow objects, the immediate ancestors of bells, were constantly used. The latter first worn on the person, then transferred to the hand, and finally used on the ends of batons or staves, have been the direct forerunners of bells, and from their universal use in primitive times among all people in connection with worship has undoubtedly descended the historic use of bells in connection with religious and other ceremonies. Used in religious ceremonies in ancient Egypt, Assyria, and Palestine, also in Greek camps and Roman baths. Adopted by the Christians for calling to church about the 4th century. Introduced into France 550, England 680, Switzerland and Germany 11th century. Rung as defense against thunderstorms by order of Pope John ab. 900. Baptism of ch. bells dates from 10th century.

Bellwort. Plants of the genus *Uvularia*, natural family *Liliaceæ*, natives of N. America.

Belmont, MO. Scene of an engagement Nov. 7, 1861. Grant gained the day, but was compelled to retire.

Belodontidæ. Sub-order of extinct (Triassic) Reptiles, allied to the Crocodiles, having the nares at base of snout, near the eyes, enabling them to feed with snout partly submerged. They lived on e. shores of the U. S., and grew to a length of 10 ft.

Beloit College, WIS. Founded by Congregationalists 1845. It has a faculty of 20, ab. 400 students; a library of 18,000 vols.

Belomancy. Divination with arrows, anciently practiced by heathen Arabs, Babylonians (see Ezekiel xxi. 21), and many nations. The custom was widely diffused among the native peoples of America, and highly specialized arrows are still used for the purpose among the Indians of the s. w. U. S. It is the basis of a large number of games, among which are pachisi and chess.

Belot, ADOLPHE, 1829–1889. French dramatist and novelist, *Mlle. Giraud*, 1870; *Alphonsine*, 1887.

Belpaire Fire-box. In locomotive boilers, a type in which the transverse crown-bars which support the flat crown-sheet of the ordinary type are replaced by radial stay-bolts, and the outer shell over the crown-sheet is brought down quite close to the latter. The boiler has therefore no wagon top, and the dome is put more to the front. The crown-sheet is rounded

and inclined slightly upward and forward. The outer sheet is inclined forward and upward a little more to facilitate the circulation and disengagement. The fire-door is at the extreme back of the cab. The particular advantages of this construction are the lightness and flexibility of the staying of the crown-sheet of the fire-box.

Bel-Phegor. Same as Baal-Peor; Moabitish deity worshiped with obscene rites.

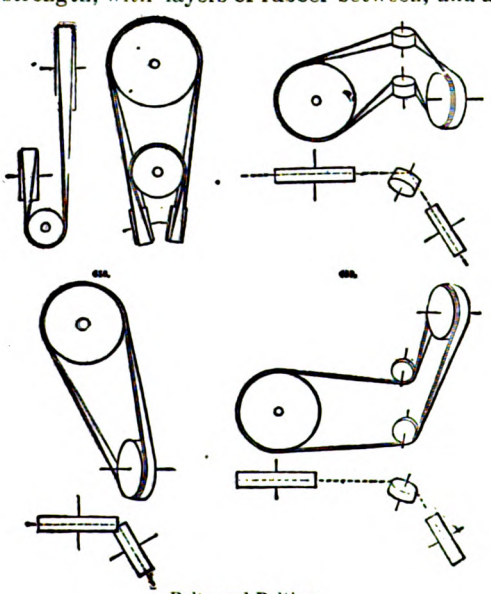
Belshazzar, d. 538 B.C. Babylonian king mentioned in Daniel as reigning in Babylon when occupied by the Persians; son of the usurper Nabonidus, and grandson of Nebuchadnezzar; probably representing his father, who was then absent in the field, and therefore omitted in the regal lists; known from the inscriptions as a man of military prowess.

Belt OF HIGH PRESSURE. Long, rather narrow, region over which the barometric pressure (reduced sea level) is higher than that on either side. Such ridges frequently connect two areas of higher pressure and last but a day or two; but the belt that nearly surrounds the earth near the Tropic of Capricorn is permanent. The corresponding belt in the northern hemisphere lies north of the Tropic of Cancer, and varies more with the seasonal change of the sun's position.

Belt, THOMAS, 1830–1878. English mining engineer, naturalist, and traveler; excellent meteorological and climatological observer and theorist.

Beltane. Celtic fire-festival. The custom in France and Great Britain of driving cattle between two fires as a preservative against disease, is a survival of these rites. The fires of St. John's Eve and Easter in n. Europe thus originated.

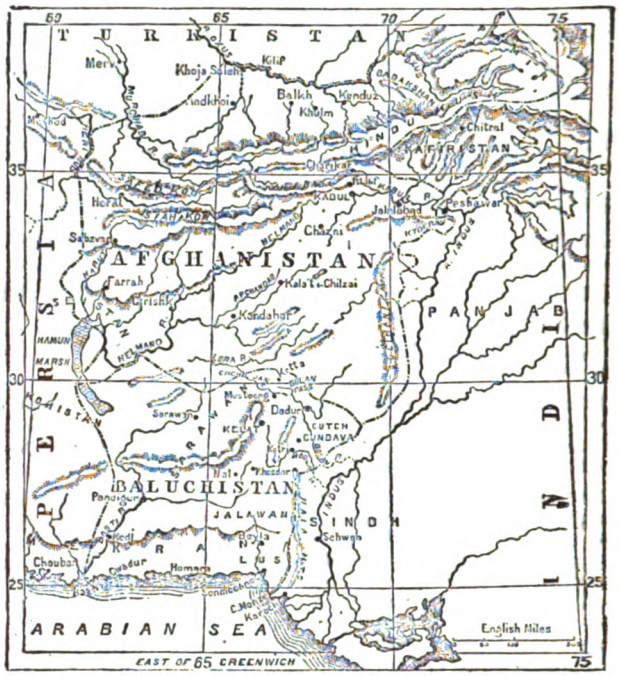
Belting. In the transmission of power by endless bands from one shaft to another, is, properly, such of these bands as are flat. The most usual flat belt is made of oak-tanned leather, the greater length being made up of short pieces from the hide, cemented together at a scarf joint, and copper rivets and burrs hold the joint from tearing apart. Belts can thus be of indefinite length, and have been made up to 60 in. wide. Leather belting is not adapted for damp places. Rubber belt is made by calendering woven canvas or duck in as many "plies" as necessary for strength, with layers of rubber between, and an outer



Belts and Belting.

covering of rubber incloses the whole. Such belts can therefore be of indefinite length without piecing, and of a width limited only by the length of the calendering rolls. Rubber belts are suitable for damp places, but will not withstand high heat, nor can they be shifted by a jerk from fast to loose pulleys. They are much used in grain elevator practice. Raw-hide, canvas, and composite belts have also been used. A convenient formula for belt transmission is that each inch in width will transmit one horse-power, where the speed is 600 feet per minute. Where the arrangement of belts is unfavorable to transmission by this means, the belt must be made wider, or must be run faster. The last joints in endless belting are made by lacing or by special forms of hooks or studs. Where the driving and driven axis are separable, or where a tightener or straining pulley can be used, even the last joint may be cemented and the shock at high speeds and the weakening effect of the lacing may be avoided. Double leather belts are used for higher strains.

Beluchistan. Country of Asia, between Afghanistan and the Arabian Sea, w. of India and e. of Persia; area ab. 130,000 sq. m. It is inhabited by barbarous tribes, numbering some 500,000. The capital is Kelat, pop. 14,000. The Khan of Kelat



Sketch Map of Beluchistan.

holds control of the country, but the British have an agent there and it is controlled by them. The people are nomadic, Mohammedan, and of two races, Brachui and Beluchis.

Belus. See BEL.

Belvedere Collection. Nucleus of the Vatican Gallery of Antiques, named from the Pope's garden of the Belvedere, in which it was first placed. It dates from ab. 1510. The Belvedere Apollo and Belvedere Torso of Hercules are hence named.

Belzoni, GIOVANNI BATTISTA, 1778–1823. Italian antiquarian, who lived in England as an athlete 1803–12, went to Egypt 1815 as a hydraulic engineer, and won fame by his explorations of the temple of Ipsamboul, the tomb of Seti I. at Thebes, and the pyramid of Shafra. *Narrative*, 1821. He died in an attempt to explore Central Africa.

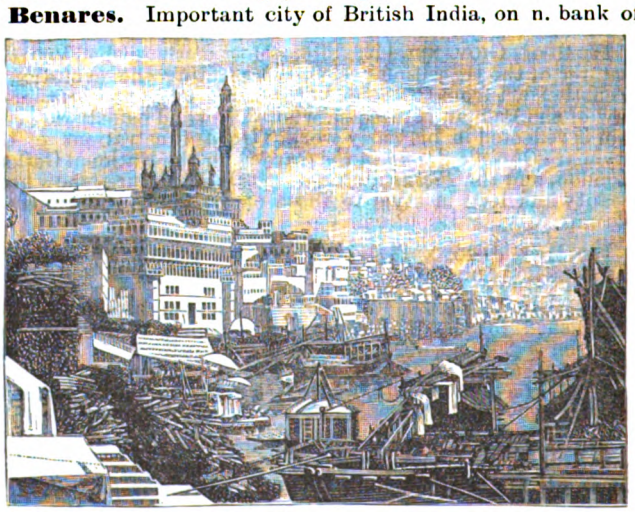
Bem, JOSEPH, 1795–1850. Polish officer who led the Hungarian armies 1848–49, and then entered the service of Turkey.

Bema. The semicircular recess in a Roman basilica, which formed the tribunal, and which, in Christian churches, became the apse.

Bembo, PIETRO, 1470–1547. Sec. to Leo X. 1513; cardinal 1539. His *History of Venice*, 1551, extends from 1486 to 1513. He wrote also letters, dialogues, and sonnets, and bore an active part in the Revival of Learning.

Bemis' Heights. Saratoga co., N. Y., near Hudson R.; scene of a battle with Burgoyne, Sept. 19, 1777.

Benares. Important city of British India, on n. bank of



Benares.

the Ganges, in the N. W. provinces. Pop., 1891, 222,520, of

which about three-quarters are Hindoos and the rest Mohammedans.

Benbow, JOHN, R.N., 1653–1702. Captain 1689, admiral 1696. Unsupported he engaged a French fleet near Jamaica Aug. 20–24, 1702.

Bench. Seat of judicial officers; also the officers as a class, as opposed to the bar or practicing lawyers.

Bench. One or more layers of a bedded mineral deposit, such as a coal seam, whether in the upper, central, or lower part of the deposit, kept distinct from the others in the working of a mine.

Bench Mark. Stone monument or permanent object in the ground, whose elevation above tide water is known, and which serves as the starting-point for running lines of levels. One of the first operations in a topographical survey is the establishment of bench marks and the determination of their elevations.

Bench-Warrant. Process issued by a judge or court for the arrest of a person charged with some offense, and his production before a court or judge.

Bend. One of the nine Heraldic Ordinaries, formed by two parallel lines drawn diagonally, at equal distances from the Fesse-point, from the Dexter Chief to the Sinister Base, *i.e.*, downward from left to right.

Bendant, FRANCOIS SULPICE, 1787–1852. French mineralogist. *Voyage mineral. et geol. en Hongrie*, 3 vols., 1822.

Bender. Town of Russia, on the Dniester, ab. 50 m. from its mouth: taken from the Turks by the Russians Sept. 28, 1770, and again 1789 and 1809. Pop. ab. 50,000.

Benedek, LUDWIG VON, 1804–1881. Austrian general, distinguished in Italy and victor of Solferino 1859; defeated at Sadowa 1866.

Benedetti, VINCENT, COUNT, b. 1817. Corsican lawyer and French ambassador to Berlin 1864. He had much to do with bringing on the war of 1870–1.

Benedicite. Hymn from the Apocrypha, an expansion of Ps. 148; used from ab. 350, in the R. C. service, after the mass; in Prayer Book, a substitute for *Te Deum*.

Benedict. Name of fourteen popes. I. 574–578; II. 684–5; III. 855–858; IV. 900–903; V. 964, rival to Leo VIII., removed by Otho I.; VI. 973–4; VII. 974–983; VIII. Theophylact of Tusculum, 1012–24, he crowned Henry II., defeated the Saracens, and held a council at Pavia; IX. nephew and namesake of the last, 1033–48, the "boy-pope," of evil life, deposed by Henry III. and d. 1055; X. John Mincius, "the dull," 1058–9; XI. Nicolaus Bocusini, b. 1240, pope 1303–4, canonized; XII. Jacques Fournier, pope at Avignon 1334–42, another good man; XIII. Pietro Francisco Orsini, b. 1649, pope 1724–30, attempted reforms (Pedro de Luna of Aragon, Anti-pope 1394–1424, was deposed by the Councils of Pisa, 1409, and Constance, 1417, but adhered to for some time by Spain, Portugal and Scotland); XIV. Prospero Lorenzo Lambertini, b. 1675, cardinal 1728, Abp. of Bologna 1731, pope 1740–58, was pure, moderate, and scholarly, a friend to learning and to reform, and noted as a canonist.

Benedict, OF NURSIA, ST., 480–543. Founder, ab. 529, of the Benedictine order, long of almost undivided prevalence in the West. They were of moderate rule, eminent for learning, pub. valued editions of the Fathers, and had several branches; 4,000 of them, it is said, became bishops, 200 cardinals, and 24 popes, while 1,500 were canonized. They now have 16 houses in Gt. Britain and many in the U. S. for monks and nuns.

Benedict, DAVID, 1779–1874. Pastor at Pawtucket, R. I., 1806–31; historian of the Baptists, 1813.

Benedict, SIR JULIUS, 1804–1885. German musical composer and conductor, whose activities were given to England. He assisted at Jenny Lind's American concerts, 1850–52, and was knighted 1871. He was for three years a pupil of Von Weber, on whom he wrote a book.

Benedictine. Liqueur made at Fécamp, Normandy, since 1863. It is claimed to have originated with the monks, at a much earlier date, which is doubtful.

Benedictines. See BENEDICT.

Benediction. Invocation of the divine blessing at the close of a Protestant service, or in varied ways and with more state in those of the R. C. Ch.

Benedictus. Canticle which has followed the Lesson at Lauds in the Christian Church for over 1,000 years. It is the song of Zacharias from Luke i. More extensively used by musical composers is the *Benedictus qui venit* of the mass.

Benedix, JULIUS RODERICK, 1811–1873. German playwright and novelist.

Benefice. In the R. C. Ch., any clerical office.—In the Anglican, usually a parish cure.—Of old, land bestowed for military services.

Beneficence. Material and active well-doing, prompted by a feeling of benevolence.

Benefit of Clergy. Originally, exemption of clergy from jurisdiction of lay courts; later, exemption from capital punishment. It had its origin in the pious regard of early Christian princes for the Church, and was continued because it served to mitigate the severities of criminal law; was abolished in England 1827–28; never a part of the Federal criminal law, and abrogated in the States.

Benefit Societies. Associations formed to receive from their members periodical contributions, and to use this fund for the pecuniary relief of the needy.

Beneke, FRIEDRICH EDUARD, 1798–1854. German educator; prof. Univ. Berlin 1832. *Logic*, 1842; *Psychology*, 1850.

Beneventum. City of s. Italy, now Benevento; scene of total defeat of Pyrrhus by the Romans 274 B.C., and of Hanno by T. Gracchus 214; also of the victory of Charles of Anjou over Manfred, king of Sicily, Feb. 26, 1266; nearly destroyed by an earthquake 1688. Pop. 23,000.

Benevolence. Condition of mind in which love to man is dominant, in which the affections that tend to unite men are present, and all that tend to separate them are absent or of inferior force. Human happiness is its sole object.

Benevolent Affections. Divided, according to their object, into conjugal, parental, filial, fraternal, and other forms of family affection, friendship, the love of fellow-citizens and countrymen, love to the human race, and finally, love to animals or inanimate objects which we may personify.

Benfey, THEODOR, 1809–1881. German philologist; prof. Göttingen 1842. His chief researches were in Oriental and Indo-European philology; his conclusions in regard to the Eastern origin of most of our popular tales (märchen) have been accepted by many modern scholars. *Sanskrit Dictionary*, 1866; *Hist. Philology*, 1869.

Bengal. E. province of India. It became independent 1340; was added to the Mogul empire ab. 1529, and ceded to the the English Aug. 16, 1765. Area 156,564 sq. m. Pop., 1891, 71,346,987.

Bengal, BAY OF. Large arm of the Indian Ocean, between India on the w. and the Malay peninsula on the e.

Bengal-Grass. Millet, *Chamæraphis Italica*, a grass of European origin.

Bengali. Aryan dialect used by the natives of the province of Bengal.

Bengal Lights, or BLUE LIGHTS. Used for signaling at sea; containing 6 parts niter, 2 parts sulphur, and 1 part antimony trisulphide, intimately mixed.

Bengel, JOHANN ALBRECHT, D.D., 1687–1752. German commentator, father of New Testament criticism. *Apparatus Criticus*, 1734; *Gnomon*, 1742, tr. 1862.

Beni Hassan. Site of a series of rock tombs of the 12th Dynasty, about 2,600 B.C., cut in the barren hillside overlooking the Nile, ab. half-way between its mouth and Thebes. These tombs are famous for their Proto-Doric columns, anticipating the earliest known Greek Doric ab. 2,000 years, and for their paintings of domestic scenes, daily life, and occupations of ancient Egypt.

Beni-Israel. Race of Jewish origin, in Bombay and vicinity.

Benjamin. Youngest son of Jacob, full brother of Joseph, and ancestor of that one of the twelve tribes of Israel which, though greatly reduced in numbers by a severe punishment (Judges xix.–xxi.), furnished the first king, and was conjoined with Judah in the Kingdom. St. Paul was a Benjamite.

Benjamin OF TUDELA, NAVARRE, d. 1173. Jewish rabbi, who traveled extensively and in his *Itinerary* describes his visit to Constantinople, Egypt, Persia, and China.

Benjamin, JUDAH PHILIP, 1811–1884. U. S. Senator from La. 1853–61; Confederate Sec. of War 1861, and of State 1861–65; called to the English bar 1866. *Digest of Decisions of Supreme Court of New Orleans*, 1834; *Law of Sales*, 1868.

Benjamin, PARK, 1809–1864. American poet and journalist.

Benjamin, SAMUEL GREENE WHEELER, b. 1837. U. S. Minister to Persia 1883–85. *Constantinople*, 1860; *Art in America*, 1877; *Persia*, 1886.

Benjamin Bush. *Lindera Benzoin*. Odorous shrub of the Laurel family, native of the e. U. S. Known also as Spice Bush, Wild Allspice, and Fever Bush.

Bennett, JAMES GORDON, 1795–1872. Scottish-American journalist; founder and ed. *N. Y. Herald*, 1835.—His son, namesake and successor, b. 1841, lives mostly in Paris.

Bennett, Sir William Sterndale, D.C.L., 1816–1875. English pianist and composer, pupil chiefly of Cipriani Potter, who was a pupil of Mozart; conductor of the London Philharmonic Society, principal of the Royal Academy, and prof. at Cambridge 1856; knighted 1871.

Bennigsen, Levin August Theophil, Count, 1745–1826. Russian general of German birth, eminent in the war against Napoleon, especially at Borodino and Leipzig.

Bennington, Vt., Battle of. Aug. 16, 1777, between a detachment of Burgoyne's army and a body of Vt. and N. H. militia under Col. John Stark. A monument to commemorate the victory was erected 1891.

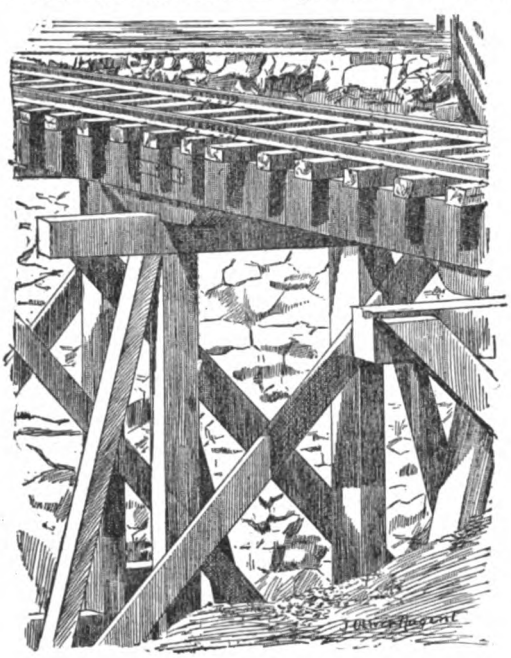
Benoit, Pierre Leopold Leonard, b. 1834. Belgian composer, founder and director of the Flemish Music School in Antwerp 1867.

Benoit de Sainte-Maure. French poet of 12th century. *Romance of Troy.*

Benson, Edward White, D.D., D.C.L., b. 1829. Bp. of Truro 1877; Abp. of Canterbury 1822. *The Cathedral*, 1877.—His son, Edward Frederick, b. ab. 1860, wrote the novel, *Dodo*, 1893.

Benson, Joseph, 1748–1821. English Wesleyan divine, biographer of J. W. Fletcher, and apologist of Methodism 1793, 1801. *Commentary*, 1811–18.

Bent. Framework, consisting of sill, posts, braces and cap, which forms one of the supports of a trestle for a railroad track, and on which the track stringers are laid. In the figure



Bent.

a short bolster is seen between the track stringer and the cap of the bent.

Benten (Ben-zai Ten). One of the seven gods of good fortune of Japan, and the object of a serious cult. She is identified with Sarasvati (q.v.).

Bent-Grass. Grasses of the genus *Agrostis.*

Bent-Grass, White. See Fiorin.

Bentham, George, F.R.S., 1800–1884. English botanist, nephew of Jeremy, pres. Linnean Society. *Labiatarum genera et species*, 1832; *Flora Hongkongensis*, 1861; *Flora Australiensis*, 5 v., 1863–70; *Genera plantarum*, with J. D. Hooker, 1862–83.

Bentham, Jeremy, 1748–1832. English utilitarian philosopher and law-reformer. His books, never popular, have had much influence on thinkers, and probably more in France than at home. *Defense of Usury*, 1787; *Principles of Morals and Legislation*, 1789; *Civil and Penal Legislation*, 1802; *Theory of Penalties and Rewards*, 1811–25; *Judicial Evidence*, 1813–27; *Book of Fallacies*, 1824; *Works*, 11 vols., 1843.

Bentivoglio, Ercole, 1506–1575. Italian poet, satirist and comedian.

Bentivoglio, Gui, 1579–1644. Cardinal 1621; papal nuncio in Flanders, and historian of the war there.

Bentivoglio, Hippolite. Italian poet and dramatist of the 17th century.—**His son,** Corneli, 1668–1739, cardinal and poet, tr. Statius.

Bentley, Richard, D.D., F.R.S., 1662–1742. Greatest of English classical scholars, and founder of the modern school of philological criticism; master of Trinity Col., Cambridge, 1700, and divinity prof. 1717; noted alike for learning, arrogance, and pugnacity. His *Dissertation on the Epistles of Phalaris*, 1699, provoked great controversy. His plan for a revised N. T. text, collated from all the MSS., bore fruit after his death.

Benton, Thomas Hart, 1782–1858. U. S. Senator from Mo. 1821–51; M.C. 1853–55; Democratic leader. For his opposition to paper money he was called "Old Bullion." *Thirty Years' Views*, 1854–56; *Abridgement of Debates in Congress*, 15 vols., 1857.

Bentonville, N. C., Battle of. March 19–21, 1865. Confederate loss, 2,700; Union loss, 1,600.

Benzal Chloride. $C_6H_5.CH:Cl_2$. Bpt. 206° C. Dichlor compound, obtained by action of chlorine upon hot toluene, or hot benzyl chloride. Liquid called also benzylidine chloride.

Benzaldehyde. $C_6H_5.CHO$. Oil of bitter almonds, Bpt. 179° C. The aldehyde corresponding to benzoic acid and the simplest aromatic aldehyde in structure. It can be obtained from amygdalin present in bitter almonds by the decomposition of this glucoside, but is usually prepared by heating benzal chloride with water. Liquid of almond odor, largely used in the manufacture of artificial greens. Upon oxidation furnishes benzoic acid.

Benzaldehyde Green, or Benzal Green. $C_{52}H_{53}N_4O_{12}$. Prepared by action of benzaldehyde on dimethylaniline and the oxidation of the product. Double salt of tetramethyldiamidotriphenyl carbinol. Called also malachite green and known by a variety of names. The common aniline green of trade.

Benzamide. $C_6H_5.CO.NH_2$. Mpt. 130° C. White solid. Amide of benzoic acid or ammonia in which one hydrogen atom is conceived to be replaced by the benzoyl group. Prepared by heating ammonium benzoate. Soluble in hot water and alcohol.

Benzanilide. $C_6H_5.NH.C_6H_5CO$. Mpt. 158° C. The anilide containing the benzoyl group. Prepared from benzoyl chloride and aniline. See Acetanilide.

Benzaurine. $C_{19}H_{13}O_3$. Mpt. ab. 100° C. Product of the action of benzotrichloride on phenols; reddish crystalline powder.

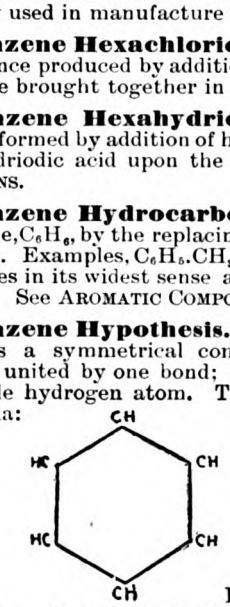
Benzene. C_6H_6. Benzol. Bpt. 80.5° C. Fundamental hydrocarbon of the aromatic or benzene series. Contains six carbon atoms united in a ring form: HC CH / HC CH / HC CH. Liquid formed by the action of heat upon coal, and therefore present in coal tar, from which it is obtained by distillation. It yields nitrobenzene with nitric acid and benzene sulphonic acid with sulphuric acid. Disc. by Faraday 1825, and detected in coal tar by Hofmann 1845. It is an excellent solvent for resins, fat, etc. Chiefly used in manufacture of aniline.

Benzene Hexachloride. $C_6H_6Cl_6$. Mpt. 158° C. Solid substance produced by addition of chlorine to benzene when the two are brought together in sunlight.

Benzene Hexahydride. $C_6H_6.H_6$. Bpt. 69° C. Compound formed by addition of hydrogen to benzene, by the action of hydriodic acid upon the latter. See Benzenoid Hydrocarbons.

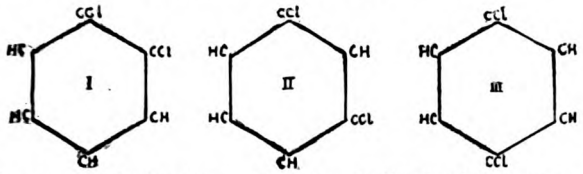
Benzene Hydrocarbons. Hydrocarbons derived from benzene, C_6H_6, by the replacing of the hydrogen by hydrocarbon groups. Examples, $C_6H_5.CH_3$, toluene; $C_6H_5.C_2H_5$, ethylbenzol. Includes in its widest sense all hydrocarbons of the aromatic series. See Aromatic Compounds.

Benzene Hypothesis. In terms of this hypothesis benzene is a symmetrical compound composed of six carbon atoms united by one bond; to each carbon atom is attached a single hydrogen atom. This is expressed by the hexagon formula:



From this conception, it follows that there should be six identical mono-substitution products obtained by successively replacing the six hydrogen atoms by six atoms of a univalent element, capable of replacing hydrogen, as chlorine. If two hydrogen atoms are replaced by chlo-

rine there should be three different di-substitution products, to which have been assigned the following formulæ:



To compounds having a structure similar to that represented by formula I is given the name "Ortho compounds"; II represents "Meta compounds"; III, "Para compounds." The hypothesis was proposed by Kekulé in 1865. See META COMPOUNDS.

Benzene Sulphonic Acid. $C_6H_5.SO_2.OH$. Monobasic acid produced by the action of sulphuric acid upon benzene. Very soluble in water. Crystallizes in very fine, deliquescent needles. The anhydrous acid melts at 40–42° C.

Benzenoid Hydrocarbons. Derived from the benzene hydrocarbons by direct addition of hydrogen. Benzene hexhydride, $C_6H_6.H_6$, is an example. Present in large quantities in Russian petroleum.

Benzidine. $H_2N.C_6H_4.C_6H_4.NH_2$. Mpt. 122° C. Diamidodiphenyl. Base, remarkable for its power of uniting directly with cotton fiber without a mordant. This power is possessed also by its derivatives. Prepared from hydrazobenzene by the action of acids, hence from azobenzene. White crystalline substance, soluble in hot water.

Benzidine Colors. Artificial dye-stuffs prepared from benzidine and the compounds closely related to it, as tolidine. Remarkable for their ability to unite directly with vegetable fibers without the intervention of a mordant.

Benzine. Benzoline mixture of low boiling hydrocarbons, obtained by the distillation of petroleum. It consists largely of hexane, C_6H_{14}, and heptane, C_7H_{16}. It is used as a solvent and for enriching illuminating gas. That of 62° B. is used as a substitute for oil of turpentine in cheap paint. of 70° B. for cleansing, and 74° B. for dissolving india-rubber. These are now termed "naphthas."

Benzoazurin. $C_{34}H_{24}N_4O_{10}S_2Na_2$. Blue dye-stuff consisting of the sodium salt of the sulphonic acid, prepared by the action of diazoderivative of dianisidine upon the sulphoacids of α-naphthol and α-naphthylamine. Dyes cotton blue without a mordant.

Benzoic Acid. $C_6H_5.COOH$. Mpt. 121° C. Union of the carboxyl group (COOH) with the phenyl group (C_6H_5). The simplest aromatic acid. Monobasic acid found in certain resins, particularly gum benzoin. Also in the urine of herbivorous animals in hippuric acid, and it is obtained together with benzaldehyde by the action of water upon benzyl chloride and benzal chloride. Flat, colorless plates, subliming easily.

Benzoic Aldehyde. See BENZALDEHYDE.

Benzoic Anhydride. $C_6H_5.CO.O.CO.C_6H_5$. Mpt. 42° C. Anhydride of benzoic acid. Prepared by the action of benzoyl chloride upon sodium benzoate.

Benzoic Ether. $C_6H_5.CO.O.C_2H_5$. Bpt. 211° C. Ethyl benzoate. Made from ethyl alcohol and benzoic acid in the presence of hydrochloric acid gas.

Benzoin. $C_6H_5.CH(OH).CO.C_6H_5$. Mpt. 137° C. Oxbenzylphenyl ketone, formed by allowing benzaldehyde to stand in contact with potassium cyanide solution. Colorless crystals.

Styrax Benzoin.

Benzoin. *Styrax Benzoin.* Tree of natural family *Styracaceæ*, native of Malaya, from which the gum-resin is obtained. Used as incense and in perfumery.

Benzol. See BENZENE.

Benzoline. Bpt. 70° C. to 100° C. Petroleum distillate, called petroleum spirit or ligroin.

Benzonitrile. $C_6H_5.CN$. Phenyl cyanide. Bpt. 191° C. Oil, smelling like oil of bitter almonds.

Benzophenone. $C_6H_5.CO.C_6H_5$. Mpt. 49° C. Diphenyl ketone. Simplest aromatic ketone. White crystalline solid prepared by heating calcium benzoate.

Benzopurpurin. Several red dye-stuffs, prepared from orthotolidine and the naphthylamine sulphonic acids, and are sodium salts of sulphonic acids. They dye cotton a brilliant scarlet without the aid of a mordant.

Benzotrichloride. $C_6H_5.CCl_3$. Bpt. 213–214° C. Trichlor compound prepared by the continued action of chlorine upon hot toluene or of chlorine upon benzal chloride. Fuming liquid.

Benzoyl. $C_6H_5.CO$. Group derived from benzoic acid ($C_6H_5.CO.OH$) by the removal of hydroxyl (OH) from it. Resembles the ACETYL GROUP (q.v.).

Benzoyl Chloride. $C_6H_5.CO.Cl$. Bpt. 198° C. Combination of benzoyl with chlorine, prepared by the action of phosphorus pentachloride upon benzoic acid. Fuming liquid, decomposed easily by water.

Benzyl Alcohol. $C_6H_5.CH_2.OH$. Bpt. 206° C. Hydrate of the benzyl group, $C_6H_5.CH_2$. Liquid with aromatic odor which occurs combined in Peru and tolu balsams and can be obtained also from benzyl chloride or from benzaldehyde.

Benzyl Chloride. $C_6H_5CH_2Cl$. Bpt. 179° C. First product obtained by action of chlorine upon toluene; changed to benzal chloride by further action of chlorine.

Benzyl Cyanide. $C_6H_5.CH_2.CN$. Bpt. 229° C. Cyanide of the benzyl radical. Nitrite of phenylacetic acid.

Beowulf. Anglo-Saxon epic of eighth century or earlier.

Béranger, JEAN PIERRE DE, 1780–1857. French lyric poet. His *Chansons*, 1815 and later, won vast popularity and exerted no little influence; the second and fourth volumes, 1821 and 1828, caused his imprisonment.

Berberidaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 20 genera and ab. 100 species growing in the temperate regions of the northern hemisphere and S. America; commonly called the Barberry family.

Berberine. $C_{20}H_{17}NO_4+4\frac{1}{2}H_2O$. Mpt. 120° C. Alkaloidal base derived from pyridine. Obtained from the root of the golden seal (*Hydrastis canadensis*) by extracting with water. Fine yellow needles, valued in pharmacy.

Berbers (LIBYANS). Original inhabitants of n. Africa, mainly the Sahara region. Their origin is obscure, may be descended from the Iberians, with admixture of European, Egyptian (Coptic), and in the south also Soudanese (Negroid) blood. In the north Bedouin or Arabian elements have been added, resulting in the Moors; in the mountains their blood is tolerably pure. They differ from their conquerors, the Arabs, in having a lighter complexion, and even blue eyes in some cases, and in the fact that they build substantial dwellings, and are not roving tent-dwellers, though, like the Arabs, they are herdsmen. They clothe themselves with a single cloth, and the men, but not the women, wear veils. Monogamy is the rule; the girls sometimes choose their husbands; frequently property descends in the female line. The religion is Mohammedan, but modified and liberalized. Some of the tribes are robbers. In east Sahara they are called Tuaregs. In Algeria and Tunis are the Kabyles (Numidians), in Morocco the Moors.

Berceo, GONZALO DE. Spanish sacred poet of 13th century.

Berchet, GIOVANNI, ab. 1790–1851. Lombard poet, noted for his patriotic songs.

Berea College. Madison co., Ky., opened 1858; revived 1869. It offers three courses, admits both sexes, and white as well as colored pupils. It has 18 instructors, ab. 400 students, 5,000 volumes in its library, and an endowment of $100,000.

Berea Grit. Stratum of sandstone ab. 50 ft. thick, near the base of the Carboniferous Strata in Ohio. It is the most westerly important sandstone in the State, and is quarried on an immense scale near Cleveland. It extends into Pa. as the Corry and Cussewago sandstones, and crosses the Ohio s. into Ky.

Berengarius, ab. 1000–1088. French divine of Tours, opponent of Transubstantiation; forced to recant 1059 and 1079, though protected for a time by Gregory VII.

Berenice. Wife of Ptolemy Euergetes, king of Egypt. She vowed to sacrifice her hair for the safe return of her husband, absent on a military expedition. The hair disappeared somehow, and Conon, the astronomer, reported that it had been transformed into the constellation since known as *Coma Berenices*. B. was slain by her son, Ptolemy Philopator, 222 B.C.

Berenice, or **Bernice.** Jewish princess, of great beauty but loose reputation, wife of her uncle, Herod, king of Chalcis, and then of Polemon, king of Cilicia; daughter of Herod Agrippa I., sister of Herod Agrippa II., with whom her rela-

tions were suspicious. Before these two St. Paul pleaded. She was afterward mistress of Vespasian and Titus.

Beresina. River in Russia, in crossing which Napoleon's main army was defeated by the Russians Nov. 25–29, 1812, with loss of ab. 28,000 men.

Berg. Former German duchy, joined to electorate of Bavaria 1624; enlarged by Napoleon, given to Murat, as grand-duchy 1806, and to Louis Bonaparte 1808, and to Prussia 1815.

Bergamot. *Citrus Bergamia.* Shrub of the Orange family, which yields a perfume.—Also, in Europe, *Mentha citrata*, herb of the Mint family.

Bergamot, WILD. *Monarda fistulosa.* Tall, odorous herb of the Mint family, native of N. America.

Bergen. City and seaport on w. coast of Norway. It has

Bergen.

a fine harbor and considerable commerce, especially in dried fish. It is the most important port in the country. It has some manufactories and shipyards. It was founded in 1069. Pop., 1891, 53,686.

Bergen, HOLLAND. Scene of a defeat of the Allies under the Duke of York by the French under Brune Sept. 19, 1799. The duke gained a victory here over Brune Oct. 2, but was defeated at Alkmaar Oct. 6, and capitulated Oct. 18.

Bergen-op-Zoom. Town of n. Brabant; vainly attacked by the Spaniards 1588, 1605, and 1622; taken by the French Sept. 16, 1747, and 1794; attempted by the British in a disastrous assault March 8, 1814. Pop., 1890, 12,667.

Berger, GEORGES, b. 1834. French civil engineer; connected with the management of Expositions of 1867, 1878 and 1889; Director-General of the last named.

Bergerac. Town of France, on the Dordogne. Here a treaty was signed between Henry III. and the Huguenots Sept. 17, 1577. Pop., 1891, 14,735.

Bergerac, SAVINIEN CYRANO DE, ab. 1620–1655. French dramatist and satirist. *Agrippina; Journey to the Moon; History of the Sun.*

Bergh, HENRY, 1823–1888. American dramatist, better known as founder (1866) and long president of the Society for Prevention of Cruelty to Animals. By his successful efforts for this society, his name became a synonym for the purest beneficence.

Berghaus, HEINRICH, 1797–1884. German geographer of high authority; prof. Acad. Architecture, Berlin, 1824; ed. *Geog. Year-book.* His *Physical Atlas* was carried further by his nephew HERMANN, 1818–1890, who pub. other important charts and maps.

Berghern, NIKOLAAS, 1625–1683. Dutch painter.

Bergk, THEODOR, 1812–1881. Prof. at Marburg 1842, and Halle 1857–67; historian of Greek literature and editor of several classics.

Bergmann, CARL, 1821–1876. Orchestral leader in New York. One of the first to introduce Wagner.

Bergsoe, JORGEN VILHELM, b. 1835. Danish novelist, long resident in Italy. *Rome under Pius IX.*, 1874–77.

Beri-Beri. Disease common in Japan and the East Indies, in which are dropsy, disturbances of the sensation, pain, paralysis, and atrophy of the muscles, the legs being most commonly affected. It occurs most often in men exposed to malarial influences and improperly nourished, and in its acute forms is fatal. It is probably due to a bacterium of some sort; the change visible after death is an inflammation of the nerves, distributed to the affected parts, which may ascend and attack the spinal cord.

Bering, or BEHRING. VITUS, 1680–1741. Danish seaman in the Russian service; discovered Bering Strait 1728.

Bering Sea. Part of n. Pacific, between Siberia and Alaska, limited on the s. by the Aleutian Islands.

Bering Sea Controversy. Between U. S. and Great Britain as to extent of Russia's ceded rights in B. Sea. Settled at Paris, Aug. 7, 1893, by arbitrators, 2 from Great Britain and U. S. each, one from Sweden, France and Italy each. The decision was as follows:

1. Russia (1821–1824) admitted that her jurisdiction in said sea only reached a cannon-shot from shore and had never since in fact asserted or exercised exclusive rights therein beyond the ordinary limits of territorial waters.
2. Great Britain had never conceded such claims.
3. The body of water known as B. Sea was included in the phrase "Pacific Ocean" used in treaty of 1825.
4. Russia's rights passed to U. S.
5. U. S. have no right to protection of, or property in, seals outside the three-mile limit.
6. Establishes:—I. A sixty-mile zone around Pribilof Islands for seal protection.

II. Close season, May 1—July 31, on open sea n. of 35th parallel.

III. None but sailing-vessels allowed.

IV. Such vessels to be licensed.

V. Masters to supply the two Governments with number and sex of seals captured.

VI. Nets, fire-arms and explosives prohibited at all times within B. Sea.

VII. The two Governments to see that only fit men are engaged.

VIII. Regulations not to apply to Indians sealing on their own account.

IX. Both Governments to reconsider above regulations every five years.

Bering Strait. A passage connecting B. Sea with the Arctic Ocean and separating Asia from N. America; 45 m. wide.

Berington, JOSEPH, 1746–1827. English R. C. divine and author. *Faith of Catholics* (with J. Kirk), 1813; *Literary History of the Middle Ages*, 1814.

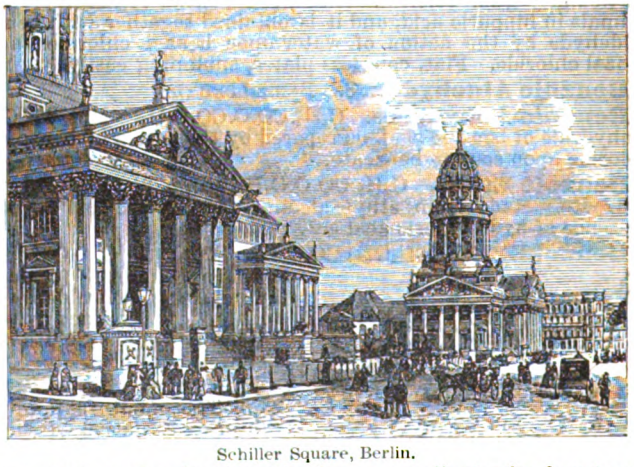
Bériot, CHARLES AUGUSTE DE, 1802–1870. Founder of the Franco-Belgian school of violin playing, and composer for the violin.

Berkeley, GEORGE, D.D., 1685–1753. Irish philosopher, Dean of Derry 1724; bp. of Cloyne 1734; in New England 1728–31. The poet Pope ascribed "to B. every virtue under heaven." His system carried idealism to extreme lengths. *Alciphron*, 1732.

Berkeley, SIR WILLIAM, ab. 1610–1677. Gov. of Va. 1641–51 and 1660–76.

Berkley, GEORGE, b. 1821. Chief engineer of the India Peninsular Railway; pres. Inst. Civil Engineers 1892.

Berlin. Capital of Prussia and of the German empire; on R. Spree. It is irregularly laid out, with wide streets and many open parks, supplied with water, and is sewered. It is the



Schiller Square, Berlin.

seat of the national university, has an excellent school system, an academy of sciences, and numerous museums. It contains many large publishing houses, and is an important center of manufactures and trade. Pop., 1891, 1,579,244.

Berlin Blue. See PRUSSIAN BLUE.

Berlin, CONGRESS OF. Held to settle the Eastern Question, June 13 to July 13, 1878; treaty ratified Aug. 3. Bulgaria, Montenegro, Servia and Roumania were declared independent; Ardahan, Kars and Batoum were ceded to Russia by Turkey; the Porte agreed to make legal reforms, and to grant religious liberty; navigation of the Danube was regulated.

Berlin Decree. Issued Nov. 20, 1806, by Napoleon. It declared the British Isles to be in a state of blockade, interdicted trade with England, confiscated property belonging to British subjects, and prohibited vessels from Britain or her colonies from entering the harbors of France. See MILAN DECREE.

Berlin Museums. The Royal Museum dates from the construction of the Old Museum by Schinkel with its magnificent Ionic portico 1824. The New Museum is a large addition by Stüler 1843. The picture gallery of the Old Museum is the best in Europe as regards historical balance and generally representative quality, but does not rival several others in number of masterpieces. The collection of antiques was of subordinate importance until the acquisition of the Greek reliefs from Pergamus, found 1879–80. The upper rotunda is hung with 7 tapestries from cartoons by Raphael, duplicating the pieces in the Vatican. The New Museum contains the finest collection of sculpture casts in Europe, as regards arrangement and large representative choice. Its other possessions of antiquities in vases, etc., are of great value. Here is also the splendid Egyptian collection, found by the Prussian expedition headed by Dr. Lepsius. Two other museums in Berlin have developed from collections originally in the Royal Museum, and now transferred to separate and magnificent buildings; the Industrial Museum, opened 1881, and the Ethnographical Museum, opened 1886, containing the Schliemann collections from Troy and a vast exhibit for all departments of Ethnology. The modern picture gallery of Berlin is the new National Gallery, opened 1876, of great extent, but of very minor importance in the quality of the paintings.

Berlin Spirit. Inferior grade of whisky.

Berlin, UNIVERSITY OF. Founded 1809. In 1813 it had 36 teachers; in 1860, 173; in 1891, 336 instructors and 5,527 students, of whom 757 were in theology, 1,630 in jurisprudence, 1,397 in medicine, and 1,743 in philosophy, besides 2,567 non-matriculated. The library contains 300,000 vols., and students have access to the Royal Library of 900,000 vols. across the street. In 1890–91, 757 courses were offered, 30 of which were in Oriental languages. Some 400 students are usually in attendance from the U. S. Ever since its foundation it has been famous for the eminent scholars in its faculties. Its degrees are highly prized.

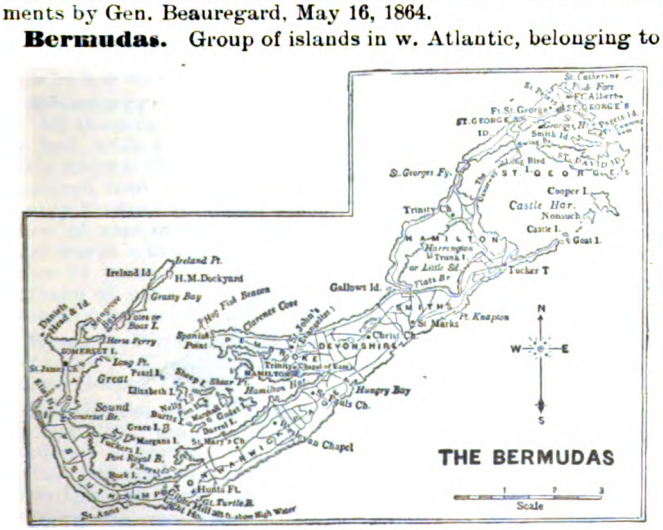
Berlioz, HECTOR, 1803–1869. French musical composer and author of an inestimable work on instrumentation; an original genius, unappreciated in his own country until after his death, and with Wagner the most powerful influence in modern music. After repeated failures at the Paris Conservatoire, he took the Roman Prize 1830, spent three years in Italy, and acted as a newspaper critic in Paris while his works were neglected. The "Berlioz cult" in France was a result of the war of 1870. He is the head of the composers of programme music. His chief works are: Overtures, *Francs Juges*, *Roi Lear*, and *Carnaval Romaine;* Symphonies, *Fantastique*, *Roméo et Juliette*, and *Harold en Italie;* Operas, *Benvenuto Cellini*, *Béatrice et Benedict*, *La Prise de Troie*, and *Les Troyes á Carthage;* *Grande Messe des Morts*, *Te Deum*, *La Damnation de Faust*, *L' Enfance du Christ.* Literary works: *Grand Traité d'instrumentation*, etc., *Voyage Musical*, *Les Soirées de l'orchestre*, *Les Grotesques de la Musique*, *A travers Chants*, *Memoires.*

Berm. Top of the bank of a canal on opposite side of towpath.

Bermuda-Grass. *Capriola Dactylon;* grass of the Old World, adventive in America and becoming a bad weed in the Southern States.

Bermuda Hundred, VA. On James R., ab. City Point. Here Gen. Butler was driven back with loss to his intrenchments by Gen. Beauregard, May 16, 1864.

Bermudas. Group of islands in w. Atlantic, belonging to



Great Britain, said to number over 300; most of them merely rocks. The climate is uniform. Discovered by Bermudez, a Spaniard, and called Sommers Isles after Sir George Sommers, who was wrecked here in 1609. Pop., 1891, 15,884.

Bernadotte. See CHARLES XIV.

Bernard, CLAUDE, M.D., 1813–1878. Prof. Coll. of France 1855; physiologist, noted for his researches on the liver.

Bernard, ST., 1091–1153. Abbot of Clairvaux 1115. The soul of his age, as thinker, preacher, hymnist and international arbiter; energetic defender of the Jews against persecution, and accuser of Abelard, Arnold of Brescia, and other heretics. His works were tr. 1889 and later.

Bernard, OF MENTONE, 923–1007. Monk of Aosta, Italy; founder, ab. 962, of the hospices in the Savoy Alps.

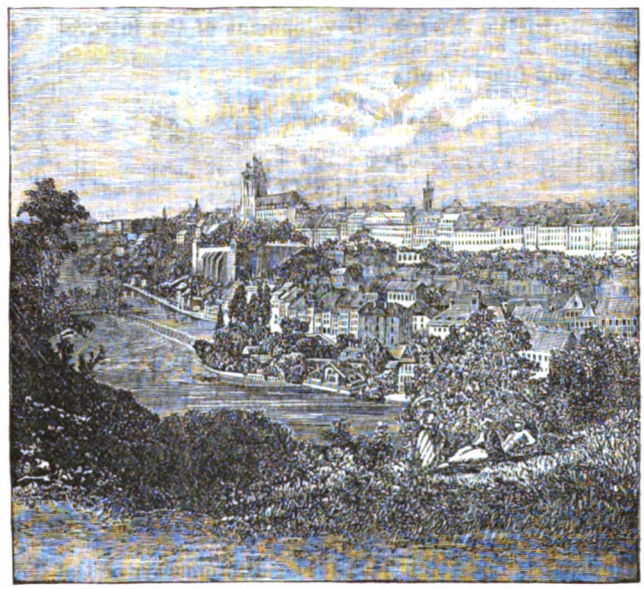
Bernard, OF MORLAIX, 12th century. Monk of Cluny, and author of the remarkable poem, *De Contemptu Mundi*, partly tr. by Dr. Neale, 1859, and containing the splendid hymn, *Jerusalem the Golden.*

Bernard, GREAT ST. Lofty pass in the Alps, crossed by Napoleon 1800; famous for its hospice, with life-saving monks and dogs.

Bernardin, OF SIENA, 1380–1444. Vicar-general of the Franciscans 1437; reformer of the order, and famous preacher; canonized 1450. His day is May 20.

Bernays, JACOB, 1824–1881. Prof. at Bonn from 1854; biographer of Scatiger and expounder of Aristotle.

Berne. Capital of the Swiss confederation, on the R. Aar;



Berne.

seat of a university. It is 1,700 ft. above the sea, and is one of the best built towns of Europe. Duke Berthold V. founded it in 1191 and so named it, from having killed a bear here. Pop., 1888, 46,009.

Berners, JULIANA, b. ab. 1388. Prioress of Sopewell, and supposed author of books on hawking, hunting, fishing, heraldry, and armory, pub. 1486.

Bernhard, DUKE OF SAXE-WEIMAR, 1604–1639. He joined Gustavus Adolphus 1631; assumed command at Lützen 1633 after the king's death and secured the victory; was defeated by the Imperialists at Nordlingen 1634; gained many victories in Burgundy, Alsace, and Lorraine 1636; defeated imperial forces June, 1637; took Brisach 1638.

Bernhardt, SARAH, b. 1844. French actress of Jewish lineage. She appeared 1862, was connected with the Théâtre Français 1868–80, and has since won triumph in America and throughout the world. She is also a sculptor, painter, and dramatist.

Bernhardy, GOTTFRIED, 1800–1875. Prof. at Halle from 1829; ed. Suidas, and historian of Greek and Latin literature 1830–36. *Encyc. of Philology*, 1832.

Berni, FRANCISCO, ab. 1490–1536. Italian comic poet, who rewrote Boiardo's *Orlando Inamorato*, 1541. The fame of this and of his *Burlesque Rhymes*, 1538, gave the name "Versé Berneschi" to all later efforts in this vein.—His namesake, a count, 1610–1693, was a dramatic and lyric poet.

Bernicia. Ancient kingdom of England, extending from the Forth to the Tees; united with Deira to form Northumbria.

Bernini, GIOVANNI LORENZO, 1598–1680. Italian architect and sculptor. As sculptor he represented and controlled the taste of the whole 17th century period, both in Italy and north-

ern Europe. This taste looked to the theatrical and startling in pose, and the minutely realistic in execution. Instances are his works in the Borghese Villa, *Apollo and Daphne, Rape of Proserpina.* As architect he shared and accented the defects of his time; viz., lack of feeling for constructive expression and for refinement of detail; but he had much sense of monumental composition and effect. Instances are his colonnade before St. Peter's Ch. and the Scala Regia of the Vatican. The whole interior decoration of St. Peter's, as it now stands, was essentially molded and executed according to his taste. His characteristic tombs of Popes Urban VIII. and Alexander VII. are there.

Bernouilli. Family of Swiss mathematicians.—JACQUES, 1654–1705, prof. Basel 1687, invented the logarithmic spiral and investigated the curve called Figure of Eight or Lemniscate of B. Works, 2 vols., 1744.—His brother JEAN, 1667–1748, prof. at Groningen 1695–1705, and then at Basel, began discussion of the exponential calculus and of analytical trigonometry, first denoted the accelerating influence of gravity by a distinct symbol, and used the notation ϕx for a function of x. He was a very able teacher, constantly in controversies.—Of his sons, NICOLAS, 1695–1726, was prof. at St. Petersburg; DANIEL, 1700–1782, prof. at Basel from 1733, gained ten prizes of the French Academy for discoveries in math. and physics; JEAN, 1710–1790, was prof. at Basel 1748, and had two sons, JEAN (3d), 1744–1807, astronomer royal and director of math. studies at Berlin, and JACQUES, 1758–1789, prof. at Basel, Verona, and St. Petersburg. Another NICOLAS, 1687–1759, nephew and cousin of the above, was prof. at Padua.

Bernouilli's Series. Development of the integral of a differential of one variable.

X.= any function of x;

$$\int X dx = Xx - \frac{dX}{dx}\cdot\frac{x^2}{1\cdot 2} + \frac{d^2X}{dx}\cdot\frac{x_3}{1\text{-}2\text{-}3} - \frac{d^3X}{dx}\cdot\frac{x^4}{1\text{-}2\text{-}3\text{-}4} + \ldots\ldots$$

Beroidæ. Laterally compressed *Ctenophores*, without tentacles, but with fringe-like appendages on the periphery of the polar spaces. The body is oval, the stomach large, the radiating tubes ramified and anastomose, united by a circular canal near the mouth.—Also, a group termed *Eurystomeæ* or *Eurystomata.*

Berold, WILHELM VON, b. 1837. Prof. Physics at Munich, and of Meteorology and Terrestrial Magnetism at Berlin; member Acad. Science and director Meteorological Inst.

Berosus. Babylonian priest, author of a Greek history of Chaldea ab. 270 B.C. Beginning with the most remote antiquity, it extends to the time of Alexander. Many important fragments have survived.

Berquin, ARNOLD, 1749–1791. French writer of juvenile books, once very popular.

Berquin, LOUIS DE, 1490–1529. Protomartyr of the Reformation in France, burned in Paris.

Berri. Old French province which gave title to various princes.

Berruyer, JOSEPH ISAAC, 1681–1758. French priest, who turned the Bible into a dubious romance. *Histoire du Peuple de Dieu*, 7 vols., 1728; N. T. parts, 6 vols., 1753–57. Both were condemned, but were long popular, and tr. into Italian, Spanish, and German.

Berry. Simple fruit, fleshy throughout, with a thin skin or rind, as the grape, gooseberry, and tomato.

Berryer, PIERRE ANTOINE, 1790–1866. French legitimist, noted for eloquence; academician 1854.

Berserker. Hero of Norse mythology, who fought without coat of mail; father of twelve warlike sons.

Bersier, EUGENE ARTHUR FRANCOIS, 1831–1889. Protestant divine, pastor in Paris from 1855; noted for eloquence. *Coligny*, 1884.

Bert, PAUL, 1833–1886. Prof. of Physiology in Paris 1869. Author of many works on the relation of climate, especially barometric pressure, to animal life.

Bertheau, ERNST, 1812–1889. German commentator on O. T.; prof. at Göttingen 1843.

Berthelot, MARCELLIN PIERRE, b. 1827. Prof. Coll. France, minister of education; best known for his synthesis of organic compounds. *Les Origines de l'Alchimie*, 1885.

Berthier, LOUIS ALEXANDRE, 1753–1815. Bonaparte's chief of staff from 1796; minister of war 1799; marshal of France 1804; Prince of Wagram 1809. *Memoirs*, 1826.

Berthier, PIERRE, 1782–1861. French chemist and mineralogist; prof. Ecole des Mines, Paris; author of a work on assaying in the dry way, pub. 1833.

Berthold, OF RATISBON, ab. 1220–1272. Evangelist; first German preacher of his age.

Berthollet, CLAUDE LOUIS, M.D., 1748–1822. French phlogistonist, ennobled 1815, whose experimental researches were especially valuable. He determined the composition of ammonia, prussic acid and hydrogen sulphide with a fair degree of accuracy. *Dyeing*, 1790. His *Statique Chimique*, 1803, still has powerful influence upon the question of chemical affinity.

Bertin, ANTHONY, 1752–1790. French poet. *Elegies*, 1782.

Bertin, LOUIS FRANCOIS, 1766–1841. Founder and conductor of the Paris *Journal des Debats*, 1799; ed. from 1841 by his son, LOUIS MARIE ARMAND, 1801–54.

Bertinazzi, CHARLES ANTHONY, or CARLINI, 1713–1783. French actor, of Italian birth.

Bertola, GEORGE DI, 1752–1798. Italian essayist and poet.

Bertoloni, ANTONIO, 1775–1869. Italian botanist in Bologna. *Herb. et zoöl. Italiæ*, 1819; *Prolegomena ad Floram Italicam*, 1827; *Flora Italica*, 10 vols., 1833–54; *Flora Italica cryptogama*, 1858–67.

Bertrand, HENRY GRATIEU, COUNT DE, 1773–1844. French military engineer; Napoleon's adjutant 1806; ennobled 1809.

Berwick, JAMES FITZ-JAMES, DUKE OF, 1670–1734. Natural son of James II. of England; marshal of France 1706. He defeated the English at Almanza 1707, and was killed at Philipsburg, Baden.

Beryl. $Be_3Al_2Si_6O_{18}$. Widely distributed mineral, hexagonal in crystallization, consisting of silica, alumina, and glucina; bluish or greenish. Two transparent varieties, the emerald and the aquamarine, are used as gems. The oriental emerald of jewelry is a green corundum. The common beryl is frequently found associated with granite veins, and sometimes in crystals of great size, but not sufficiently clear and free from flaws to be highly valued. Siberia, Brazil and India have furnished many handsome stones.

Beryllium, or GLUCINUM. Be. At.wt. 9.03; Sp. gr. 1.64. Discovered 1828, by Wöhler, who decomposed the chloride with potassium. Its silicate occurs in nature as beryl and emerald; does not decompose in water, and is not oxidized in the air at ordinary temperatures. It is dissolved by dilute hydrochloric and sulphuric acids, and by sodium and potassium hydroxides. It is sometimes called glucinum, because some of its salts are sweet.

Beryllium Carbonate. Be_2CO_5. Basic salt formed by adding sodium carbonate in slight excess to a solution of beryllium sulphate.

Beryllium Chloride. $BeCl_2$. Formed by the action of chlorine upon beryllium; or a mixture of beryllium oxide and carbon treated with chlorine. It is very soluble in water and very deliquescent.

Beryllium Hydroxide. $Be(OH)_2$. White gelatinous substance, soluble in caustic alkalies; made by adding an alkali to a solution of beryllium sulphate.

Beryllium Sulphate. $BeSO_4$. Made by dissolving beryllium hydroxide in sulphuric acid. When crystallized from water it has the composition $BeSO_4.4H_2O$.

Beryx. One of the earliest Teleostean fishes, with large, ctenoid scales, anterior dorsal fin, consisting of rays only; found in the chalk of e. England; allied to the Perch.

Berzelius, JONS JAKOB, 1779–1848. Swedish chemist, prof.

Jons Jakob Berzelius.

of medicine and pharmacy at Stockholm 1807, baron 1835, senator 1838. He was a man of tremendous energy and of un-

bounded enthusiasm for his science, a brilliant teacher and experimenter. His great activity led him to investigate many branches of chemistry. Of special importance was the collection of the results of his arduous investigations in tables of atomic and molecular weights of elements and compounds; he was able to give original figures for about 2,000 substances. His best-known work is his *Lehrbuch der Chemie*, 3 vols., 1808–18, long a model for the text-books.

Bes. Egyptian deity, represented as a dwarf with bowed legs, grotesque face, feather head-dress, and lion-skin with tail hanging between the legs; god of joy and of war, in some ways kindred to the Hindoo Siva; not known before 19th dynasty; of foreign introduction, probably from Arabia. A Typhonic deity, but not identical with Set.

Bes.

Besancon. City of France, on R. Doubs. The chief industry is the manufacture of watches and jewelry. Pop., 1891, 56,065.

Besant, Walter, b. 1839. English novelist of high repute and great activity, colaboring with James Rice (q.v.), in *Ready Money Mortiboy*, 1871, and others till 1882. His *All Sorts and Conditions of Men*, 1882, had public results. His *Rebel Queen*, 1894, embodies a close study of London Jews.

Besenval, Pierre Victor, Baron de, 1722–1791. French writer of memoirs.

Beskow, Bernhardt von, 1796–1868. Swedish dramatist and poet. *Eric XIV.*

Bessarabia. Province of s. w. Russia, conquered by Turks 1474, taken by Russians 1770, and ceded to them 1812. Part of it was annexed to Roumania 1856, but restored to Russia 1878.

Bessarion, Joannes, 1395–1472. Learned Greek priest, Abp. of Nicœa 1437. He attended the Council at Ferrara and Florence 1438–9, and labored for the union of the Greek and Roman Churches. It proved abortive, and he remained in Italy, where he tr. Aristotle and other classics, and did much to promote Greek learning and Plato's philosophy. Cardinal 1439, titular patriarch of Constantinople 1463.

Bessel, Friedrich Wilhelm, 1784–1846. German mathematician and astronomer; prof. Königsberg 1810. His great work was the reduction of the Greenwich Observations of Bradley. He pub. *Fundamenta Astronomica*, 1818, with two continuations, and contributed largely to *Astronomische Nachrichten*.

Bessels, Emil. 1847–1888. Physicist to the third Arctic expedition of C. F. Hall in the ship *Polaris*.

Bessel's Function. Development of a variable in which one factor contains any power of the variable, and the other is a convergent series, having only even powers of the variable in terms alternately plus and minus. The symbol for Bessel's Function is $J_n(x)$

$$J^n(x)=\frac{x^n}{2^n\Gamma(n+1)}\left\{1-\frac{x^2}{2(2n+2}+\frac{x^4}{2.4.(2n+2)\,(2n+4)}-\right.$$

$$\left.\frac{x^6}{2.4.6(2n+2)(2n+4)(2n+6)}+\ldots\ldots\right.$$

Where x is rational and n is algebraically greater than —1.

Bessemer, Sir Henry, b. 1813. English engineer, famous for his invention of the B. process for making steel. Though he had made some remarkable mechanical inventions, he was little known till, in 1855, he proposed "to convert five tons of cast-iron into molten malleable iron in fifteen minutes by simply blowing cold air through it," and within five years the price of merchant steel had been reduced three-fourths. The steel works which he founded repaid to the original investors after 14 years 81 times the amount originally invested (an average of nearly 100 per cent. every two months), a result probably unprecedented in the annals of commerce.

Besser, Wilhelm Friedrich, D.D., 1816–1884. German Lutheran N. T. commentator. *Bible Studies;* exposition of the fourth Gospel, tr. 1861.

Bessières, Jean Baptiste, 1768–1813. French general of division 1802, marshal 1804. He served in Italy and Egypt; rendered important aid at Marengo, Austerlitz, Jena, and Eylau; defeated the Spaniards at Medina del Rio Seco July 15, 1808; Duke of Istria 1809; killed at Lützen.

Beta Compounds. Prefix applied to substituted compounds in which the substitution is a hydrocarbon group, next but one to the group which gives character to the compound; thus betabrombutyric acid, $CH_3—CHBr.CH_2.COOH$. See Alpha Compounds.

Betaine. $(CH_3)_3N<\begin{matrix}CH_2\\O\end{matrix}>CO$. Mpt. 138° C. Trimethylglycocoll. Glycocoll ($CH_2NH_2.COOH$), in which three methyl groups replace three hydrogen atoms. White substance, very soluble in water, contained in the juice of the sugar-beet.

Betel Leaf. *Piper betel.* Climbing plant of the Pepper family, native of the East Indies.

Betel-Nut. Tall palm, native of the East Indies, bearing a hard fruit with fibrous rind. It is the *Areca catechu*, called also Pinang. It is chewed by the Malays, being wrapped in a leaf of the Piper betel with lime, as a tonic.

Betham-Edwards, Matilda Barbara, b. 1836. English novelist and poet. *Doctor Jacob*, 1864; *France of To-day*, 1892.

Bethany. Village 2 m. e. of Jerusalem, on e. declivity of the Mount of Olives; a favorite resort of the Saviour, whose friends, Martha, Mary, and Lazarus, lived there; scene of the raising of Lazarus.

Beth-el, or Bethel. Scene of the prophetic vision of Jacob (Gen. xxviii.), and long a sacred city of Israel; ab. 12 m. n. of Jerusalem; not mentioned in N. T.

Bethel College. McKenzie, Tenn.; chartered 1850, reorganized 1861. It educates both sexes; has six instructors and ab. 300 students, and is controlled by the Cumberland Presbyterian Ch.

Bethesda. Ancient pool in Jerusalem, to which intermittent powers of healing were ascribed; provided with five porches. Here a paralytic had waited 38 years, but was healed by Christ.

Bethlehem. Town of Judæa, 6 m. s. of Jerusalem, birthplace of David and of Christ. It contains the Church and Grotto of the Nativity, built by the Empress Helena 327.

Bethlehem.

Bethlehem. Borough of Northampton co., Pa., on the Lehigh River, founded by Moravians 1741. Pop., 1890, 10,302. See South Bethlehem.

Bethlehem, or Jerusalem, Council of. Held by the Greek Church 1672. It condemned Protestantism.

Bethphage. Place near Bethany. Matt. xxi. 1.

Bethsaida. Town of Galilee, or, as some think, two towns, one w. of the lake, the other on e. bank of the Jordan.

Bethune, George Washington, D.D., 1805–1862. R. D. pastor in Phila., Brooklyn, and N. Y. *Lays*, 1847.

Béton. Mixture of hydraulic cement and sand with a little water, subject to prolonged trituration; forms Béton-Coignet, an artificial stone extensively used. When broken stones are added the product is called Beton Aggloméré by the French, and generally concrete in the U. S. Béton is rarely made in blocks, but the entire structure is constructed *in situ* and forms one monolithic piece. Arches, sewers, piers and monuments have been thus built.

Betony. *Betonica officinalis.* Plant of the Mint family, native in Europe. Also, *Pedicularis Canadensis* of the e. U. S., a plant of the Figwort family, known also as Lousewort.

Betony, Wood. See Lousewort.

Bettany, George Thomas, 1850–1892. English author, ed. *Minerva Library. Eminent Doctors*, 1885; *Life of Darwin*, 1887.

Betterment. Permanent improvement by one person of another's land, for which the common law gives the improver no compensation. Equity courts and statutes, following the Roman law, have modified this rule, securing to the *bona fide* holder of land, without title, the value of his betterments in

many cases.—In England, the enhancement of an individual's property by a public improvement.

Betterton, THOMAS, 1635–1710. English actor, eminent in Shakespearian parts.

Bettinelli, XAVIER, 1718–1801. Italian author, prof. at Modena.

Beugnot, ARTHUR AUGUSTE, COMTE DE, 1797–1865. French historian. *Institutions of St. Louis,* 1821; *Jews of the West,* 1824; *Destruction of Paganism,* 1835.

Beulé, CHARLES ERNEST, 1826–1874. French archæologist; prof. in Paris 1854.

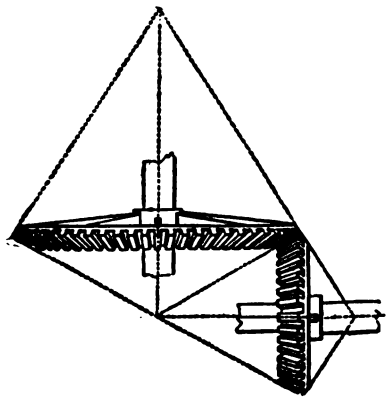
Beurenberg, JOHANN FRIEDRICH, 1777–1806. Prof. of physics at Dusseldorff, first to show by experiment the effect of the earth's rotation on falling bodies.

Beurmann, KARL MORITZ, 1835–1863. German explorer of Africa; killed in Moa, Wadai. Feb. 1863.

Beust, FRIEDRICH FERDINAND, COUNT VON, 1809–1886. Foreign minister of Saxony 1849; Austrian chancellor 1867, instituting many reforms; ambassador to England 1871–76; and to Paris 1876–82.—His relative, FRIEDRICH CONSTANTIN, b. 1806, was head of the mining bureau of Saxony, and afterward inspector-general of mines in Austria.

Bevel. Sloping edge of a board; instrument by which bevel slopes may be laid out.

Bevel-gear. When toothed wheels mesh into each other on two shafts which intersect, the wheels become bevel wheels. The pitch surfaces are cones having a common apex at the intersection of the axes. The angles of the two cones depend on the ratio of the number of revolutions of each shaft and the angle between their axes. The line of contact of the pitch cones is the diagonal of a parallelogram whose adjacent sides represent in direction the angles of the axes, and in length the angular velocities (or number of turns) of the respective shafts. Miter-gears are bevel-gears in which the shafts are at 90° and the velocities are equal. The angle of each pitch cone is 45°.



Bevel-gear.

Beveridge, WILLIAM, D.D., 1637–1708. Bp. of St. Asaph 1704. *Canons of Greek Church,* 1672; *Thoughts on Religion,* 1709.

Beverland, ADRIAAN, ab. 1654–1712. Dutch author of works deemed irreligious. *Original Sin,* 1678, French tr. 1714.

Bewick, THOMAS, 1753–1828. English wood-engraver, eminent in depicting animals. His *British Birds,* 1797–1804, is highly valued.

Beyle, HENRI, (STENDHAL) 1783–1842. French author. *Painting in Italy,* 1817; *Life of Rossini,* 1824; *Memoirs,* 1838; *Nun of Parma,* 1839; *Rouge et Noir,* and other novels.

Beyond the Seas. Outside the boundaries of a State, according to most State and Federal decisions; outside the limits of the U. S., according to others. In Britain it is defined by statute.

Beyrout. Chief seaport town of Syria, on the Mediterranean, having an important commerce and a missionary college. Pop., which is of many nations, ab. 85,000.

Beza, THEODORE, 1519–1605. Swiss theologian, b. in France. He became a Protestant 1848, prof. at Lausanne 1549, at Geneva 1559, and Calvin's successor there 1564. His writings were numerous, and had great influence in England.

Beziers. Ancient city of France, on R. Orbe, near Gulf of Lyons. It was sacked and its inhabitants massacred 1209, in the Albigensian wars. Pop., 1891, 45,475.

Bezique. Game of cards played by two, three or four players, with as many packs of cards. The Ace, Ten, King, Queen, Knave, Nine, Eight, and Seven, only are used, and rank in the order named. Eight cards are dealt to each player, and a card turned as a trump. If two play, the non-dealer leads any card and his opponent follows, but is not obliged to follow suit nor win the trick. The winner of a trick scores ten for each Ace and each Ten in the trick, and may also lay certain combinations of cards from his hand on the table, which score in the game, these cards being afterward played like the others still in his hand. The cards which may thus be laid down (declared), and the points that may be scored for each, are as follows: Seven of trumps, 10; A Common Marriage (King and Queen of any suit but trumps), 20; A Royal Marriage (King and Queen of trumps), 40; Bezique (Queen of Spades and Knave of Diamonds), 40; Double Bezique (two beziques), 500; four Aces, 100; four Kings, 80; four Queens, 60; four Knaves, 40; A Sequence (Ace, Ten, King, Queen and Knave of trumps), 250.

Bezold, JOHANN FRIEDERICH WILHELM VON, b. 1837. German meteorologist; prof. in Berlin.

Bhagalpur. City of British India, on the right bank of Ganges. Pop., 1881, 68,780.

Bhagavad-Gita. Ancient Sanskrit religious poem, forming part of the Mahabharata.

Bhang. Intoxicant and narcotic drug used for chewing and smoking in the East; made from leaves and seed capsules of wild hemp. See HASHISH.

Bhaskara, b. 1114. Hindoo writer on mathematics. Four chapters of his book have been tr. on arithmetic, on algebra, and two on astronomy and the sphere, with fragments discussing trigonometry and geometrical application.

Biarritz. French watering place on the Bay of Biscay. Pop. ab. 9,000.

Bibaculus, M. FURIUS, b. 103 B.C. Roman writer of satirical iambic verse, now lost.

Bibasic Acid. One containing two atoms of hydrogen which may be replaced by a metal; *e.g.*, sulphuric acid, H_2SO_4.

Bible. Scriptures of the Old and New Testaments, the former in Hebrew (a small part in East Aramæan), the latter in Greek, deeply tinged with Hebrew idioms. The O. T. is received by Jews and Christians; the N. T. by Christians; the whole respected by Mahommedans, though practically superseded by the Koran. Certain O. T. Apocrypha are acknowledged as canonical by Greek and Roman Catholics, but not by Jews or Protestants. Being written "from the nucleus of human nature," it is adapted above all other books to universal translation, in sharp contrast with the Koran, which is nothing if not Arab. First famous Greek version of the O. T., the Septuagint, was made ab. 150 B.C. The whole Bible was tr. into Latin (see VULGATE), and parts into Mæso-Gothic, by ULFILAS (q.v.), ab. 350. The most famous modern trs. are Martin Luther's in German, 1521–1534, and that of James I. in English, 1611. The whole Bible was tr. into Arabic by Dr. Cornelius Van Dyck. The ancient trs. into various languages are of great value for comparison as to original readings, especially the Perhitto into Syriac. MSS. of N. T. are divided into Uncials, written with square characters, and the less ancient and vastly more numerous Cursives. The principal Uncials are Codex Alexandrinus, ab. 425; Codex Vaticanus, ab. 350; Codex Sinaiticus, ab. 350. The first great editor of printed Greek N. T. was Erasmus, the chief later correctors of the Greek text, Griesbach, Lachmann, Tregelles, Scrivener, and Tischendorf. The division into chapters and verses is neither original nor ancient. The chapters were probably divided by Stephen Langton, Abp. of Canterbury, ab. 1230. The O. T. verses antedate 9th century; N. T. verses first used by Robert Stephens 1551. The Gutenberg or Mazarine Bible, in Latin, was one of the earliest printed books, ab. 1450, at Mainz.

Originally Scripture and living tradition had nearly the same authority. As time went on and tradition became more uncertain, it sank in value. The R. C. Church, however, and the Greek, substantially maintain Tradition and Scripture to be of equal authority. Protestants deny this equality, though Lutherans and Anglicans reverence immemorial usage, while Calvinists, but especially Puritans, have treated it almost with contempt. Among them Baptists carry out this principle of receiving only what is expressly sanctioned in Scripture to its fullest length. The reading of the Bible is hardly as extensive as formerly. But the reverent study of it, to understand exactly how it should read, and exactly what it means, is widening and deepening.

Bible Christians. English Methodist sect, founded 1815 by Wm. O'Bryan. It has now ab. 180 ministers and 27,000 members, besides some in Canada, Australia, etc.

Bible Revision. Initiated 1870, and accomplished by a British and an American committee, composed of eminent scholars of various denominations. The Revised N. T. appeared 1881, the O. T. 1885.

Bible Societies. British and Foreign Bible Society, the mother of all, formed 1804; American Bible Society, organized 1816. Others exist in various lands, and have circulated, in numberless languages, many million copies of the Scriptures.

Biblia Pauperum. "Bibles of the Poor." Pictures from Bible history, used 1200–1500, probably to illustrate sermons,

especially those of the begging friars. Manuscripts and BLOCK-BOOKS (q.v.).

Bibliography. Science, or, in narrower bounds, classification, of printed books and pamphlets. It has three subdivisions: Universal, National, Special. It is distinct from the study of manuscripts, inscriptions, and the like, dealing exclusively with the product of the printing-press. To use a commercial term, it does the bookkeeping for the great business of literature. It began 1545 with Gessner's *Bibliotheca Universalis*. In recent times the U. S. can boast of great activity in this department, which is daily growing in importance, and is fostered by the necessities and expansion of our great libraries, as well as by the spread of individual scholarship.

Bibliomancy. Divination by regarding as a special and personal message the first words seen on opening a Bible at random, or heard on entering a place where it is being read; custom forbidden 465, but long prevalent. Other books, especially Virgil, were anciently used likewise.

Bibliomania. Inordinate zeal in collecting rare or peculiar books, or paying enormous prices for them.

Bicêtre. Castle and fort s. of Paris; used as a prison till 1837, now as a hospital and lunatic asylum.

Bichat, MARIE-FRANCOIS-XAVIER, 1711–1802. Anatomist and physiologist. *Récherches Physiologique sur la Vie et sur la Mort; Anatomie Descriptive.*

Bichromates. Salts derived from an acid of the composition $H_2Cr_2O_7$; *e.g.*, $K_2Cr_2O_7$ potassium bichromate.

Bickerstaff, ISAAC, ab.1735–ab.1788. Irish author of comedies and farces.—Name assumed by SIR R. STEELE in *The Tatler.*

Bickersteth, EDWARD, 1786–1850. English divine and popular author; sec. Ch. Missionary Society 1816–30, and active in founding the Evangelical Alliance, 1845.—His son, EDWARD HENRY, D.D., b. 1825, Bp. of Exeter 1885, has written many hymns and poems, besides the most popular recent English epic, *Yesterday, To-day, and Forever*, 1866.

Bicocca. N. Italy; scene of a defeat of the French by the Imperialists, April 29, 1522.

Bi Compounds. See DI COMPOUNDS.

Bicuspid Teeth. Fourth permanent tooth, counting backward from the middle line, on each side of both jaws.

Bicycle. In 1815 the bicycle was first brought into England from France, consisting of two clumsy wooden wheels joined together by a wooden bar, astride which the rider sat and propelled himself by striking the ground with first one foot then the other. No real progress was apparent in the bicycle for the next fifty years, until in 1869 M. Michaux, of Paris, conceived the idea of making the driving-wheel much larger than the other. Shortly after M. Magee, also of Paris, developed the manufacture of the parts in steel and iron. From that time progress was more rapid. At about the same time, it is sometimes claimed in 1865, Pierre Lallemont constructed a roadworthy bicycle, at Ansonia, Conn. But American bicycling dates from ten years later, when Col. Pope of Boston and Harrington of England made and rode a bicycle of modern construction. The high-wheel soon gave way to the safety, or bicycle with two wheels of equal size, the first safeties being used in the early '80s, and the first one in America in 1885. The terms "ordinary" and "safety" are commonly used to distinguish the two types of bicycles, although the ordinary or high-wheel has now become practically obsolete.

Ordinary Bicycle, 1879.

Safety Bicycle, 1895. Weight, 17½ lbs.

The line of latest development has been in the tires, the original metal tire being replaced, first by solid rubber and later by pneumatic tires, rubber tubes filled with air. The rims also have progressed in the point of increased lightness from heavy metal to lighter metals and finally wood. The old high wheel weighed 50 lbs., the modern safety is often under 25, and racing wheels as low as 15 lbs. The increase of the use of bicycles in U. S. is shown by the fact that in 1885 there were 6 manufactories, with an output of 11,000 wheels; in 1890, 17, producing 40,000; while in 1895 there are 126, with a probable output of 500,000 machines. This will undoubtedly tend to develop better roads throughout the country. The speed attained is something remarkable, as the following records show up to 1895.

The "Ordinary," Mile Records:

3.11	1881	W. W. Stall.
2.57	1882	G. M. Hendee.
2.50	1883	G. M. Hendee.
2.39	1884	Sandy Sellers.
2.35	1885	Richard Howell.
2.34	July 1886	G. M. Hendee.
2.29¼	Oct. 1886	W. A. Rowe.
2.28¼	July 1890	F. J. Osmond.
2.25	Sept. 1890	W. W. Windle.
2.23⅖	1891	W. W. Windle.
2.22⅕	1892	W. F. Murphy.

The "Safety," Mile Records:

2.43	1885	Richard Howell.
2.33	June 1888	A. P. Englehart.
2.31⅘	Sept. 1888	S. G. Whittaker.
2.20⅗	1890	W. C. Jones.
2.16	July 1891	F. J. Osmond.
2.15	Oct. 1891	W. W. Windle.
2.11	Aug. 1892	Geo. F. Taylor.
2.08⅘	Sept. 1892	H. C. Tyler.
2.05	Oct. 1892	W. W. Windle.
2.00⅖	Oct. 1893	H. C. Tyler.
2.00	July 1894	J. P. Bliss.
1.57⅗	Aug. 1894	H. C. Tyler.

Paced Records. The favorite and most approved method of enabling a rider to make his best time on the bicycle is to have another rider (or even two upon a "tandem" machine) take the lead and keep just ahead of the record-man, being replaced at certain points by fresh men. Such records are called "paced" records.

Records of Flying Start and Paced (up to 1895):

¼-m.	23 s., Johnson, Nov. 5, '94.
½-m.	32⅘ s., " "
¾-m.	51⅕ s., " "
1-m.	1m. 11⅖ s., " Sept. 21, '94.
1¼-m.	1m. 21⅗ s., Tyler, Oct. 27, '94.
1½-m.	1m. 47⅘ s., Johnson, Nov. 21, '94.
2-m.	3m. 54⅕ s., " "

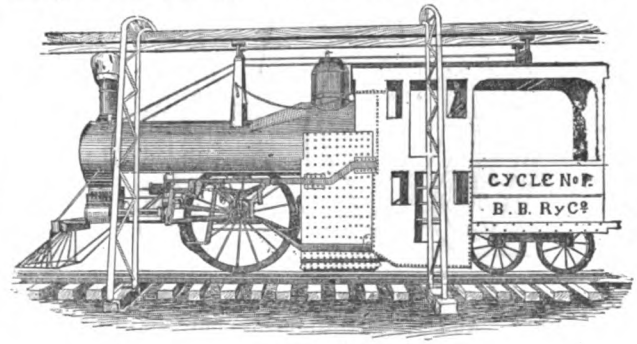
Longer distance records are as follows:

5-m.	10m. 22⅘ s., Johnson, Nov. 17, '94.
10-m.	22m. 45 s., Titus, Sept. 13, '94.
20-m.	45m. 08⅗ s., " "
25-m.	56m. 04 s., " "
50-m.	2h. 11m. 06⅖ s., Meintjes, Aug. 13, '93.
100-m.	4h. 37m. 56⅕ s., Harding, Oct. 24, '94.
300-m.	18h. 23m. 15 s., Gimm, Oct. 15, '94.

Tandem Mile Record (up to 1895; bicycle with two riders): 1m. 52⅗ s., Haggerty, Williams, Oct. 27, '94.

Quadruplet Mile Road Record (bicycle with four riders): 1m. 41⅘ s., Rhodes, Callahan, Seavey and O'Connor, Oct. 23, '94.

Bicycle Railway. Proposed system in which locomotive and cars run upon a single rail, and are prevented from overturning by an overhead elevated rail against which hori-



Bicycle Railway.

zontal wheels lightly press. It is claimed that the system will result in great economy of construction. In 1891 a short trial section of such a railway was built near Coney Island, N. Y.

Bicyclers. These riders have the same legal rights on highways as drivers of other vehicles, in the absence of statutory modification.

Biddeford. City of York co., Me., on Saco R. It has manufactures of cotton and lumber. Pop., 1890, 14,443.

Bidding Prayer. In Greek, Anglican, and other liturgies; now nearly obsolete.

Biddle, NICHOLAS, LL.D., 1786–1844. Pres. U. S. Bank 1823–36, and of another so called 1837–41; pres. also of the trustees of the fund to found Girard College.

Bidpai. See PILPAY.

Biebrich Scarlet. $C_{22}H_{14}N_4S_2O_7Na_2$. Sodium salt of the compound obtained by action of the diazo compound from amidoazobenzene disulphonic acid upon β-naphtol. Red dye-stuff used in dyeing wool. Called also ponceau.

Biedermann, ALOYS EMANUEL, 1819–1885. German rationalist; prof. at Zurich from 1850. *Free Theology*, 1844; *Christian Dogmatics*, 1869.

Biedermann, FRIEDRICH KARL, b. 1812. Prof. at Leipzig 1838–45 and 1849–53. *Philosophy from Kant to our Time*, 1842–43.

Bielids. Meteoric swarm, the constituents of which are believed to be fragments of Biela's lost comet. The earth encounters this stream in November; the radient is in the constellation Andromeda.

Biennial. Vegetable structures enduring for two seasons, as the fleshy roots of carrots and turnips.

Bienville, JEAN BAPTISTE LEMOINE DE, 1680–1768. French Gov. of La.; founder of New Orleans, 1718.

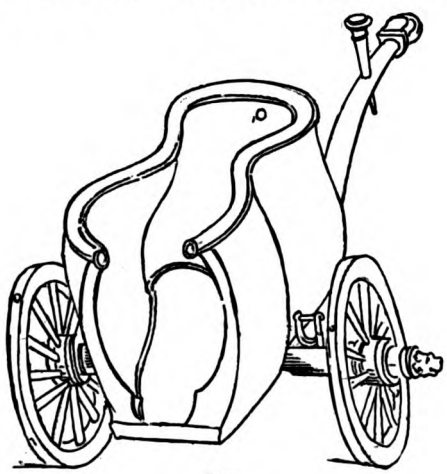
Bierstadt, ALBERT, b. 1830. German-American painter, noted especially for his pictures of the Rocky Mountains.

Bifilar Suspension. If a rod AB be suspended by two parallel cords and then rotated through an angle θ about a point half-way between the cords, it will be lifted slightly and a component of its weight will be developed which will tend to restore it to its former position. It can be shown that the moment of this restoring force is proportional to sin. θ and thus if θ be small the oscillations of such a system will be approximately simple harmonic. This suspension is used in some forms of electrometers, magnetometers, and galvanometers.

Biforines. Raphides-bearing cells of *Caladium*, and other aroids.

Bifrost. In Norse mythology, the bright Asa-bridge which leads to the underworld; the rainbow.

Biga. Two-horse chariot anciently employed in war; much depicted in marble or bronze as architectural ornaments.



Biga.

Bigamy. The marriage of one, who has a living spouse, with another. An ecclesiastical offense only, until 1603, when made a statutory crime. Honest belief of the spouse's death is not generally a defense.

Big Bethel, VA., BATTLE OF. June 10, 1861. Union forces under Gen. Pierce attacked and were repulsed.

Big Black River, MO., BATTLE OF. May 17, 1863. Unionists captured garrison and stores.

Bigelow, FRANK HAGAR, b. 1851. Prof. in U. S. Weather Bureau 1891; author of *Studies on the Solar Corona and its Relation to Terrestrial Meteorology and Magnetism.*

Bigelow, JACOB, 1787–1879. Prof. Harvard 1815–55. *Flor Bostoniensis*, 1814–40; *Am. Medical Botany*, 1817–21.

Bigelow, JOHN, LL.D., b. 1817. Ed. N. Y. *Post* 1849–61; U. S. Consul at Paris 1861–65; minister to France 1865–6; ed. Franklin and S. J. Tilden. *France*, 1871; *Molinos*, 1882; *Life of Bryant*, 1890.—His son, POULTNEY, has pub. books of travel.

Bighorn Mountains. Range in Wyoming, separating the B. and Powder Rivers. Extreme elevation 12,000 ft.

Bighorn River. In Wyoming and Montana, branch of the Yellowstone. Length ab. 450 m.

Bight of a Rope. Double part where it is folded.

Bigler, WILLIAM, 1814–1880. Gov. of Pa. 1852–55; U. S. Senator 1855–61.—His brother JOHN, 1804–1871, was Gov. of Cal. 1853–56.

Bignoniaceæ. Natural family of flowering plants, of the class *Angiospermæ*, subclass *Dicotyledones*, and series *Gamopetalæ*, comprising 55 genera and ab. 500 species, widely distributed throughout the tropics. Commonly called the Bignonia family.

Trumpet Creeper (*Tecoma radicans*). Vine of the Bignoniaceæ.

Bigroot. Plants of the genus *Micrampeles*, natural family *Cucurbitaceæ*, natives of w. N. America.

Big Sandy River. Branch of the Ohio, forming the boundary between Ky. and W. Va. Drainage area 5,915 sq. m.

Bigsby, JOHN JEREMIAH, 1792–1881. English geologist, author of *Thesaurus Siluricus*, a list of described Silurian fossils, and of *Thesaurus Devonico-Carboniferus*, 1878.

Big Sioux River. Left branch of the Missouri, forming the boundary between Iowa and Dakota. Length 210 m., drainage area 7,880 sq. m.

Bihari-Lal. Hindi poet of 16th century. Gilchrist called him the Thomson of the Hindoos.

Bikelas, DEMETRIOS, b. 1835. Greek poet, novelist, and tr. of Shakespeare. *Greece in the Middle Ages*, 1878; *Loukis Laras*, 1879; *Tales from the Ægean*, tr. 1894.

Bilabiate. See LABIATE.

Bilateral Lithotomy. Operation for removal of stone in the bladder, in which the incision extends across the perinæum and close to the anus.

Bilateral Symmetry. Case when an organism can be cut into two portions which are counterparts but not mutually interchangeable, like the right and left halves of the body. See PROMORPHOLOGY.

Bilbao. Town of n. Spain, on the Nervion, 6 m. from Bay of Biscay; founded 1300. Iron ore is largely exported. Pop., 1887, 50,772.

Bilberry. Several species of *Vaccinium*, shrubs of the Heath family; especially *V. uliginosum*, of the northern hemisphere.

Bilbouquet (BALL-BOUQUET). Cup and ball, a favorite amusement of Henry III. of France and his courtiers. It came into fashion again under Louis XV., and its popularity was still great at the Revolution.

Bilderdijk, WILLEM, 1756–1831. Dutch poet and philologist.—His wife, KATHARINA WILHELMINA, 1777–1830, was a poet.

Bile. Clear, tenacious alkaline fluid secreted by the liver, ranging in color from reddish-brown to a bright green, the latter in man. It is secreted by the liver and is poured out into the intestines at all times, but in the largest quantities immediately after eating. Not much is known as to its exact functions, but it assists somewhat in the digestion of fats and starchy

bodies, and after fulfilling its part is reabsorbed by the intestines. Animals in whom it is prevented from entering the intestines soon emaciate and die without apparent cause. See JAUNDICE.

Bilge Water. Water which lies on the floor of a ship and cannot reach the pump-well, where it would be removed.

Bilious Colic. Extreme pain in the left side in the vicinity of the liver, caused by the passage of the gall stones from the gall bladder into the intestines, which are so large that the bile-duct is stretched violently by them. It is apt to recur, and can be relieved only temporarily by the use of opiates and anæsthetics.

Bilious Fever. Vague term for any fever in which there is vomiting of bile or a yellowish coloration of the skin. The most common condition so named is an acute indigestion with slight fever and vomiting of bile, the latter a mere accident which will always occur whenever vomiting is violent and prolonged. It is also applied to remittent fever, especially when the skin is of a yellowish hue.

Biliousness. Condition in which there is more or less disturbance of the digestion, loss of appetite, headache and constipation, incorrectly referred to an excess of bile, but due to improper food, irregular living, lack of exercise, and neglect of the bowels, all which tend to set up a disordered condition of the stomach and intestines. Attention to the diet, exercise, etc., usually prove effectual in curing it.

Bill. Written statement by creditor to debtor.—Also, proposed act of a legislature.

Bill-Broker. One who negotiates the sale or discount of notes, bills of exchange, and other negotiable paper. A large amount is negotiated by bill-brokers with banks that are unable to use all their resources in ordinary discounts. Brokers submit such paper for examination to the president or other officer of a bank, often in very large amounts, from which notes or other instruments are selected and purchased. Some banks rely largely on the paper of bill-brokers for the employment of their funds.

Billet. In mediæval architecture, a decorative molding composed of projecting cylinders arranged at regular intervals.

Billiards. This game was a development of the game of bowls, played upon a table, with a protecting ledge, a ball being pushed with a wooden rod called a mast, now mace, and driven into a pocket after striking another ball. It is claimed to have originated in the East, and to have been brought west by the Knight Templars on their return from the first crusade. During the reign of Louis XI. it was played in France, and Henry III. called it "the noble game." The Elizabethan writers mention it. In 1674 the bed of the table was made of oak or marble, slate beds being used in 1827. The cushions were first of cloth, stuffed, later of felt. India-rubber cushions were used in 1835, and about 1865 cushions of vulcanized rubber were introduced. The pockets were boxes at first, being succeeded by nets. The mace was replaced by the cue in 1734, and in 1807 the leather tip was added to this by the Frenchman Mingaud.

In England at the beginning of the 18th century the tables were square with three pockets on one side only. A small arch was placed in the middle of the table, and near by a cone called the King. At intervals the player had to put his ball through the arch and round the King without upsetting either. Two balls were used, pocketing the adversary's ball counting one, and pocketing your own losing one point, the game 3 or 5. In French billiards, 1734, also called "Doublet," the King and arch were not used, there was a pocket in each corner and one midway on the long sides of the table. The cue ball had to take a cushion before pocketing the object ball, or the latter was forced to the cushion before entering the pocket. In 1775 the French carom game appeared, a third ball being added, the carom consisting in striking the other two balls with the cue ball. Pockets were also counted as in the two ball game. In England the tables are 12 ft. by 6 ft., covered with green cloth, with rubber cushions, 6 netted pockets and 3 ivory balls $2\frac{1}{16}$ in. diameter. The game is 50 points and the counts as follows: holing the white, or the cue ball off the white, 2, the red, or the cue ball off the red, 3, a carom 2; if the player misses the object ball, the opponent counts 1, and if in the same shot his ball is holed his adversary counts 3.

In America the tables were like the English tables. 4 balls were used $2\frac{3}{8}$ in. diam., and the game 100 points. The counts were 3 for a red pocket or a carom on two red balls; 2 for a white pocket or a carom on red and white; the opponent scores 1 for a miss, 2 for holing the cue ball off the white, 3 for holing off the red, and 3 for holing after a miss shot.

This game is now obsolete. In 1861 4-pocket tables were used and caroms only counted. The French first used carom tables 5 ft. by 10 ft., without pockets, 3 balls, one point for each carom and 21 or 34 points the game. This is now the standard table for match games in France and America; the balls are $2\frac{3}{8}$ in. diam.

In 1873 the first tournament of this game took place in the U. S. In 1883 the balk line game was introduced, a line being drawn 8 ins. from the cushions, inside which only two successive shots could be made. This was succeeded in 1885 by the 14-in. balk line. The cushion carom is a still more difficult game. The pocket table is now used in the U. S. only for pool, size 5 ft. by 10 ft., and 6 pockets; the following games are played: Bottle, Chicago, Continuous, Fifteen-ball, High-low-Jack, Pin, Plant, and Pyramid pool.

Billiard records in match games, 5 by 10 table. In three-ball straight rail, highest run 1,531, by Vignaux against Slosson, 1889, Paris. Best average $333\frac{1}{3}$, Schaefer, 1879, Chicago. On $4\frac{1}{2}$ by 9 table, the highest run 3,000, by Schaefer, 1890, San Francisco. His average was 700. Champions game, triangular corner lines, 18 by 38 ins., 5 by 10 table, highest run 398, and average $38\frac{26}{38}$, by Slosson against Vignaux, 3,000 points up, 1882, Paris. Balk line game, 5 by 10 table, 8-in. line, highest run 329, average $44\frac{32}{67}$, Vignaux, 1884, Paris. Fourteen-inch line, anchor nurse, 566, Schaefer, 1893, New York; Schaefer and Ives each made average 100, 1894, Chicago. Anchor nurse barred, 350, Ives, 1894, Chicago; highest average $63\frac{8}{10}$, Ives, 1894, N. Y. Cushion caroms, 5 by 10 table, highest run 77, Sexton against Schaefer, 1881, N.Y.; highest average 10 in 200, Schaefer, 1887, Chicago.

Bill in Equity. Statement of a litigant's claim addressed to an equity tribunal. If it initiates a litigation it is original; if used to amend, supplement, or continue a proceeding, or to controvert or suspend an order or decree, or for cross-litigation, it is not original.

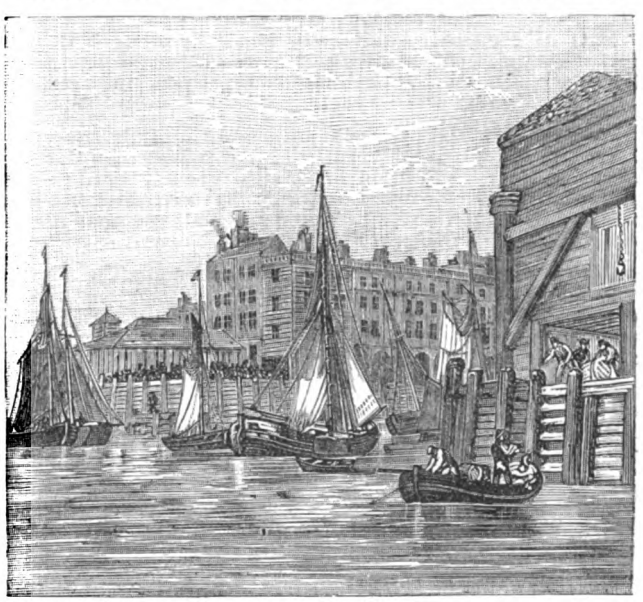
Billing, HERMANN, d. 973. Markgraf in Saxony; duke 953–61.

Billings, ELKANAH, 1820–1876. Palæontologist in the Natural History Survey of Canada under Sir William Logan 1856; author of *Four Decades of Canadian Fossils*, a report on the fauna of the so-called Quebec group, and founder of the *Canadian Naturalist and Geologist.*

Billings, JOHN SHAW, M.D., LL.D., b. 1838. *Catalogue Library Surgeon-General's Office*, 12 vols., 1880–92.

Billings, JOSH. See SHAW, HENRY W.

Billingsgate. Fish-market near London Bridge, open



Billingsgate 1820.

since 1699.—Also applied to foul language, commonly used there.

Bill of Attainder. Legislative sentence to capital punishment, with consequent forfeiture and corruption of blood, without judicial trial; forbidden to State and National Governments by U. S. Constitution.

Bill of Credit. Note issued by authority and on faith of the State for circulation as money. By the Federal Constitu-

tion the States are prohibited from issuing bills of credit; still, corporations chartered by the State may issue them. This was a favorite mode of obtaining funds by many of the colonies. Mass. led in the movement 1690. Many issues were made by Pa. On some occasions the amount of bills issued was so large that they greatly depreciated, and were redeemed at their depreciated value. The common mode of redeeming them was by the way of taxation, the taxpayers having a right to pay all or a fixed portion of their taxes in such notes, which were then destroyed. Paper issues of a bank owned by a State are not deemed bills of credit within the prohibition of the U. S. Constitution, as the bank is liable to suit on them.

Bill of Exceptions. Written statement setting forth the objections taken to judicial rulings during the trial of a cause, duly authenticated by judge or court, prepared for the purpose of presenting tbe alleged error to the proper tribunal for review.

Bill of Exchange. Unconditional order in writing by one person on another to pay to a third on demand or at a fixed or determinable future time a certain sum of money. When payable to order or bearer it is negotiable; its legal title is transferable by indorsement, or, if payable to bearer, by delivery, so that the transferer who takes it before due, for value and without notice of any defects, can enforce it in his own name, free from equities. If the person upon whom it is drawn accepts it, which is usually done by writing his name across the face, he is primarily liable. If he refuses to accept, the holder may treat it as dishonored and proceed at once against the drawer of the bill. Upon dishonor, whether by refusal to accept or to pay, the holder should give notice thereof to the drawer and indorsers, and if it is a foreign bill should have it duly protested. Such bills are said to have been invented by Jews ab. 1150, and used in England ab. 1300. De Paw says they were known at Athens and among the Arabs, but Boeckh affirms that exchange was unknown at Athens. The Abbé Raynal says the Portuguese found them in use in the East Indies ab. 1500.

Bill of Lading. Written receipt of goods and contract for their transportation by a common carrier. It is a symbol of the goods, and its indorsement and transfer operate a constructive delivery of the property. The innocent transferer for value takes them freed from the right of stoppage in transitu; but he is subject to equities generally, as a bill of lading is not fully negotiable.

Bill of Pains and Penalties. Legislative sentence to punishment less than death.

Bill of Particulars. Specification of the facts making up the claim set forth in a litigant's pleading.

Bill of Peace. Equity bill, generally brought after adverse legal proceedings have been instituted, to secure a decision which relieves complainant from multifarious or useless suits.

Bill of Rights. Granted by Charles I. of England, June 7, 1628, in answer to the Petition of Rights presented March 16. Also statutory declaration of English popular rights at the accession of William and Mary, Feb. 13, 1689. Also, constitutional provisions in the U. S. for securing personal liberty; sometimes called Declaration of Rights.

Bill of Sale. Written agreement evidencing the absolute transfer of personal property; if sealed, neither consideration nor delivery was necessary at common law to pass title, as against the seller, though his defrauded creditors might recover the property.

Billon. Subsidiary coinage of a country, of less intrinsic value than their proportionate part of the standard would indicate, and not legal tender except for limited amounts. German minor coins, till recently, were alloys of copper and silver; in most Roman denarii after ab. 220 copper washed over with silver.

Billwiler, ROBERT, b. ab. 1840. Director of meteorological office at Zurich.

Bilney, THOMAS, ab. 1495–1531. English Protestant and martyr.

Bilophodont. Teeth whose crowns are traversed by two transverse oblique ridges, separated by shallow valleys, as in Tapirs.

Bilson, THOMAS. D.D., 1547–1616. Bp. of Worcester 1596, and Winchester 1597. *Subjection and Rebellion*, 1585; *Government of Christ's Ch.*, 1593.

Bilsted. *Liquidambar Styraciflua.* Large e. American tree of the Witch-hazel family, known also as Sweet-gum and Ling.

Bimana. See ANTHROPIDÆ.

Bimetallism. Monetary system in which both gold and silver, at a fixed ratio of value, are full legal tender, and are both coined on equal terms at the national mints. Its theory is that if the legal valuation does not always correspond with that of the market the tendency will be to make payments in the cheaper metal, thereby increasing its use and value and diminishing those of the other. The two metals circulated at a relation of 15, 15½, or 16 to 1, in the leading commercial countries of the world for a long period. In 1870 the German government determined to adopt a gold standard, as England had done in 1816. A large amount of silver was thrown on the market, and at the same time silver mines of extraordinary richness were discovered in the U. S. The effect of the action of Germany and of the largely increased supply from mines was to lessen greatly the market value of silver. At once a fresh agitation began for demonetizing the use of silver. One reason for this was that the world possessed gold enough for the money of the world, and therefore silver could be discarded without any detriment to business. The market value continued to decline, but the bimetallists believed that as the value of gold and silver depended largely on their use for monetary purposes, if the leading nations of the world could be persuaded to continue to use the two metals at a fixed relation, the value of silver could thereby be preserved. Several conferences, held for this purpose, were failures.

Binary. Numbers in two figures; scales with two as a constant ratio; combination by twos.

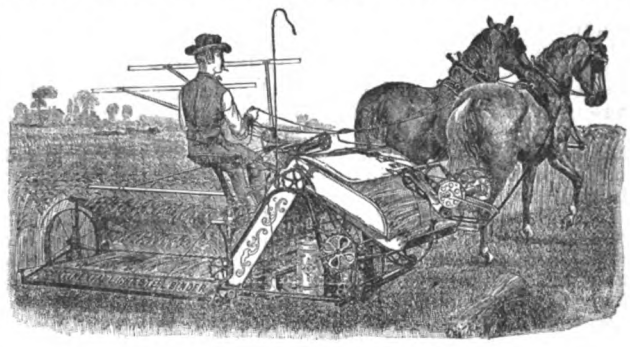
Binary Fission. Usual method of cell division, in which a cell simply splits into two halves, each assuming at once a complete individuality and similarity to its parent cell.

Binary Quantic. Algebraic expression containing two (and only two) variables.

Binary Stars. Double stars which revolve together about a common center of gravity, as the earth revolves about the sun. Ab. 200 examples are now known.

Binary Vapor Engine. One which used the vapor of ether or of the carbon disulphide (CS_2) in a second cylinder behind the primary steam cylinder. Name specially given 1847 to an engine of Du Trembley, and 1872 to that of J. H. Ellis, but applicable also to engines in which the carbon vapor is mixed with the steam. The advantage sought lies in the lower vaporizing point of the carbon vapor as compared with water; but no real or lasting economy has been attained. See CARBON DISULPHIDE ENGINE.

Binder. Grain harvesting machine that cuts and binds the grain into bundles in one operation by horse power. The



Light Steel Binder.

first machines used wire for binding, but now twine is universally employed.

Bindweed. *Convolvulus arvensis*, and other species of the same genus belonging to the natural family *Convolvulaceæ*, or Morning-Glory family.

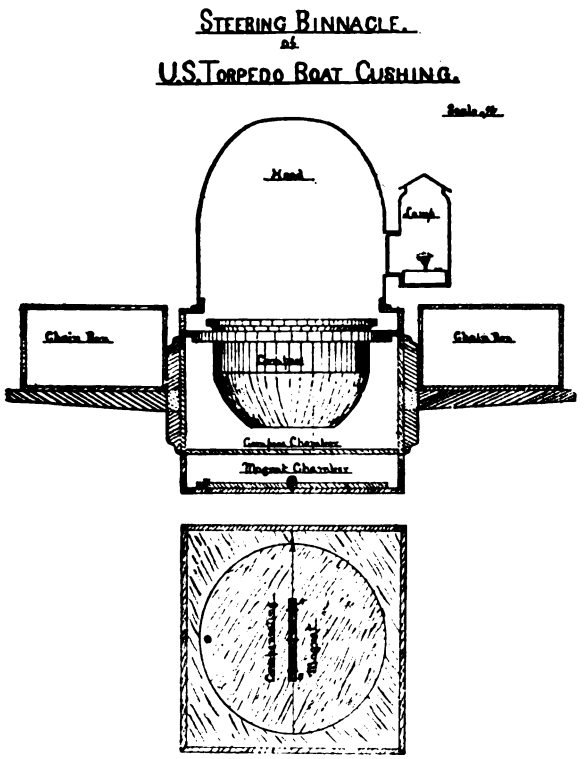
Bindweed, BLACK. *Polygonum Convolvulus.* Climbing plant of the Knotweed family, native in Europe, but naturalized in America.

Bindweed, BRACTED. *Convolvulus sepium.* Vine of the Morning-Glory family, native of the northern hemisphere, called also Hedge Bindweed.

Bingham, JOSEPH, 1668–1723. Anglican divine, whose *Origines Ecclesiasticæ*, 10 vols., 1708–22, is still the standard work on Church antiquities.

Binghamton. City of Broome co., N. Y., at junction of Chenango and Susquehanna rivers; settled 1787. Pop., 1890, 35,005.

Binnacle. Box on deck of a ship, containing compass.



Binney, HORACE, LL.D., 1780–1875. Phila. lawyer, M. C. 1833–35. *Formation of Washington's Farewell Address*, 1859.

Binney, THOMAS, D.D., LL.D., 1798–1874. Cong. pastor in London 1829–71.

Binocular Vision. Faculty by which an object is seen by both eyes and blended into one perception; dependent upon the fact that when the visual axes of both eyes are directed toward a body its image falls upon corresponding points in the two retinas. When the axes have not the same direction, a double image is the result.

Binomial. Algebraic expression of the sum or difference of two dissimilar quantities. The difference is sometimes called a residual.

Binomial Differential. A function of one variable in the form:

$$x^n(a+bx^m)^p dx.$$

Binomial Equation. Having one variable and one absolute term, and reducible to the form $x^n a = 0$.

Binomial Nomenclature. In biology, designation of each species of organisms by the generic as well as the specific term.—In botany, the former always begins with a capital, the latter only when derived from a word usually so written.—In zoölogy it is now usual to write the specific word with a small letter; *e.g.*, *Dendroica audubonì*, Audubon's Warbler.

Binomial Theorem. Formula for developing any power of a binomial. If "n" denote the required power:

$$(a+x)^n = a^n + na^{n-1}x + \frac{n(n-1)}{2}a^{n-2}x^2 + \frac{n(n-1)(n-2)}{3}a^{n-3}x^3 + \ldots\ldots$$

If "n" be a positive integer the series is finite, having (n+1) terms: otherwise it is infinite. The theorem is true for all values of n, but develops (a+x) only when $a > x$ numerically.

Biogenesis. Origin of organisms from pre-existing ones, as distinguished from abiogenesis, or spontaneous generation.

Biography. History of individuals; department of literature important from the times of Xenophon and Plutarch, and now cultivated more diligently than ever before. Biog. dictionaries, which in our time have assumed such size and prominence, began with Torrentinus 1498.

Biology. Science which studies the laws of the manifestations of life, without restriction to any particular aspects of life or kinds of living beings. For convenience it has been divided into Zoölogy and Botany, and along similar lines each of these has been subdivided according to the classification or grouping of the organisms studied. A more philosophical analysis of the subject is into Morphology and Physiology. The term was first used by Lamarck 1802, although Treviranus had used it previously, unknown to the former. It was not before Darwin and Huxley that the word became popularized. It is now frequently used, first, when both plants and animals are alone included; second, when the œcological relations, and the general phenomena which form the subject matter of Darwin's investigations, are referred to; thirdly (but now in disrepute), in a mystical sense, referring to a life principle, or biomagnetism. The history of biology previous to the times of Lamarck, Oken, Buffon, Geoffroy, etc., whose speculations are now termed "biological," is that of Botany, Zoölogy, and Physiology respectively. Even the later investigations and works of Darwin, Huxley, Spencer, Wallace, etc., are treated historically more usually in works of Zoölogy. The old term Natural History corresponds nearly to the general meaning of Biology. Huxley points out that both Psychology and Sociology are intimately related to Biology, and may properly be considered as branches of it. In addition to Morphology and Physiology he distinguishes Distribution (bathymetric, geographic, and paleontologic) and Ætiology as coördinate divisions. Biology is therefore a vast complex of sciences, equivalent in extent to all the non-biological or "physical" sciences on the one hand, and the so-called "humanity-studies" (Philology, Philosophy, Art, History, etc.) on the other. Its proper subject-study is the interaction of "life," "mind," or "soul," and "material forces," in organisms. From the biological standpoint a new and practical classification of the sciences becomes possible. The study of this group is evidently needed for any adequate conception of Philosophy or of Nature. This study is transforming all previous conceptions of life in the individual, in history, and in nations. See CELLULAR BIOLOGY.

Bion, ab. 280 B.C. Greek idyllic poet, perhaps master of Moschus, b. at Smyrna and resident in Sicily; praised for invention and elegance of versification. His most famous poem is the *Lament for Adonis*.

Bion. The "physiological" individual. This may consist (1) of a single plastid, or (2) of a cytocormus which has become integrated into a gastrula or phytula, or (3) of a colony of gastrulas (or phytulas, etc.) or polypocormus, which has become integrated into a prosopen, or (4) of a colony of prosopens which has become integrated into a deme. The chain *Salpa* or a *Pyrosoma* represents stages of the integration of a prosopocormus into a deme. See MORPHON and PROMORPHOLOGY.

Bioplasm. See PROTOPLASM.

Biorgan. Any segregation of plastides and tissues that acts as a part of a mechanism in a living organism; distinguished from IDORGAN (q.v.), *e.g.*, heart, spleen, kidney.

Biot, JEAN BAPTISTE, 1774–1862. French mathematician and physicist, prof. Coll. of France 1800, academician 1803. With Arago he measured the arc of the meridian. *Analytic Treatise on Curves*, 1802; *Physical Astronomy*, 1805–57; *Experimental Physics and Mathematics*, 1816; *Ancient Astronomy*, 1829.

Biot's Hypothesis. Supposition that the magnetic field of the earth is due to a magnet passing through its center, short in comparison with the radius and making an angle of about 20° with the earth's axis of rotation. The actual phenomena observed, however, are much more complicated than the results to which this hypothesis leads.

Biot's Laws. In Optics; deduced for the rotation of the plane of polarization of a plane polarized beam of light: (1) The amount of rotation is proportional to the thickness traversed by the ray. (2) The rotation effected by two plates is the algebraic sum of the rotations produced by each separately. (3) The rotation augments with the refrangibility of the light, and is approximately proportional to the inverse square of the wave length.

Bipinnaria. Larva of the Starfish. It has short, lobe-like arms, is bilaterally symmetrical, has no skeleton, and has a circle of cilia around the mouth-end.

Biprism. Glass prism having a very obtuse angle, used for studying the phenomenon of light interference; hence often called interference prism. If a beam of light be incident perpendicularly on the opposite flat face, it will be divided at emergence into two beams slightly inclined and in the best condition for interference, having proceeded really from a common origin. It is found under these circumstances that a series of alternate bright and dark bands is formed parallel to the edge of the prism. Sometimes known as Ohm's prism.

Biquadratic Equation. Of the 4th degree, reduced by Euler to dependence upon a cubic, and thus a general solution obtained.

Biquartz. Plate of quartz, formed of two pieces, cut at right angles to the optic axis and placed in juxtaposition. One-half of the plate is dextrogyrate, the other lævogyrate. The thickness is the same for both halves, and usually so regulated that the rotation is 90° for yellow light.

Birch. Trees and shrubs of genus *Betula*, of natural family

Betulaceæ, natives of the northern hemisphere. There are 8 species in N. America.

Birch, JAMAICA. West Indian name for *Bursera gummifera*, a tree of the Myrrh family.

Birch, SAMUEL, LL.D., 1813–1885. Egyptologist; official of the British Museum from 1836. *Hieroglyphics*, 1857.

Birch, THOMAS, D.D., F.R.S., 1705–1766. Sec. (1752) and historian of the Royal Society 1757. *Dictionary*, 10 vols., 1734–41; *Life of Abp. Tillotson*, 1752; *Memoirs of the Reign of Q. Elizabeth*, 1754.

Bird, ARTHUR, b. 1856. American musical composer, educated in Berlin, and under Liszt at Weimar.

Bird, FREDERICK MAYER, b. 1838. Army chaplain; P. E. clergyman 1868; Prof. Lehigh Univ. 1881–87; ed. *Lutheran Hymn-Book*, 1864. Has written extensively on hymnology. *Charles Wesley Seen in his Finer and Less Familiar Poems*, 1866.

Bird, ROBERT MONTGOMERY, M.D., 1805–1854. American dramatist and novelist. *The Gladiator*, 1831; *Calavar*, 1834; *Nick of the Woods*, 1837.

Bird of Paradise. Gregarious bird of the genus *Paradisea*. Found in the Eastern Archipelago, and is noted for its gorgeous plumage. About 40 species are known.

Birds. See AVES.

Bird's-Eye. Limestone in the Ordovician System of N. Y., underlying the Trenton, and so named from its appearance, which results from the calcification of minute points embedded in it.

Bird's-nest Fern. *Asplenium Nidus.* Large, simple-leaved fern, inhabiting tropical Asia and Oceanica.

Bireme. Ancient vessel propelled by rowers placed in two tiers.

Birgitta, or BRIDGET, ST., 1303–1373. Swedish "prophetess," founder in 1370 of an order of nuns and monks, at one time numbering 74 convents and extending to England and Spain; canonized 1391. Her *Revelations* were approved by the Council of Constance and tr. into most languages of Europe.

Birkenhead. City and seaport of England, on the Mersey, opposite Liverpool. It has a series of docks along its water front, a large commerce, and extensive iron manufactures. Pop., 1891, 99,184.

Birmingham. Fourth city in England; in Warwickshire, 130 m. n. w. of London. Its surface is hilly, and it is irregularly laid out. It is noted for manufactures in metals, especially iron, steel, and brass. Pop., 1891, 429,171.

Birmingham. City of central Ala., capital of Jefferson Co., important for its iron manufactures, and notable for recent and rapid growth. Pop., 1890, 26,178, exclusive of suburbs.

Birney, JAMES GILLESPIE, 1792–1857. Free Soil leader, nominee of Liberty party for Pres. U. S. 1840 and 1844.—His son, DAVID BELL, 1825–1864, was major-gen. of U. S. Vols.

Biron, ARMAND DE GONTAUT, BARON DE, 1524–1592. Marshal of France; celebrated general of Henry IV.—CHARLES DE GONTAUT, DUC DE, 1562–1602, son of last; executed for treason.

Biron, ERNEST JOHN DE, DUKE OF COURLAND, 1690–1772. Favorite of Anna of Russia, having great power, regent 1740, soon banished, but on accession of Elizabeth was recalled.

Birotulate Spicules (AMPHIDISCS). Two wheel-shaped discs, connected by a short axle, inclosing the gemmules of fresh water sponges (*Spongilla*).

Birthroot. *Trillium erectum.* N. American plant of Lily family.

Birthwort. Species of the genus *Aristolochia*, chiefly natives of tropical America.

Biscay, BAY OF. Arm of the Atlantic, washing the shores of France and Spain.

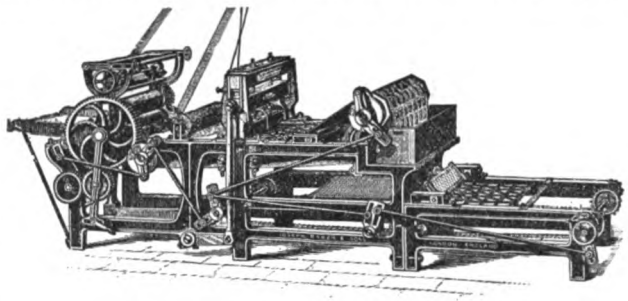
Biscayans. Inhabitants of the three Basque provinces of Spain, Biscay, Guipurcon and Alava, remnant of a peculiar race which probably once extended over a great part of Spain and s. France. Each province is governed by a parliament, chosen partly by election, partly by lot. See BASQUES.

Bischof, KARL GUSTAV, 1792–1870. German chemist and geologist; Prof. Bonn 1819. *Lehrbuch der Chemischen und Physicalischen Geologie*, 1847–54; *Internal Heat of the Globe*, 1841.

Bischoff, GOTTLIEB WILHELM, 1795–1855. Prof. at Heidelberg. *Botanik*, 1834–39; *Botanischen Terminologie und Systemkunde*, 1833–44; *Medicinisch-pharmaceutische Botanik*, 1843–47; *Flora Deutschlands und der Schweiz*, 1851.

Biscuit-Root. Species of *Peucedanum*, yellow-flowered herbs of the natural family *Umbelliferæ*, natives of n. w. N. America. The starchy roots are used by Indians for food.

Biscuits. Unleavened dough rolled into thin layers and baked; improperly termed crackers in the U. S. Also dough



Biscuit Cutting Gauging and Panning Machine.

leavened by yeast, soda, or baking powder, and baked in pieces smaller than a loaf.

Bise. Cool local wind in Switzerland, blowing down the valley of the Rhone from Lake Leman.

Bisector. That which divides any geometric object into two equal parts.

Bisexual. See HERMAPHRODITE.

Bishamon Ten. One of the seven gods of good fortune of Japan, represented as a warrior, but not particularly associated with military glory, and regarded as a god of wealth; known to students of Buddhism as the Brahminic Kuvera or Hindu Plutus, and as Vâicramana, the Maharadja of the northern quarter of Mount Sumeru.

Bishop. Governing officer in the Church from early days, with sole power of confirming and ordaining; in Greek, Roman and Anglican Churches held to be in historic succession from the Apostles. The name is disused in most Protestant bodies; with Methodists, it indicates no difference of order from elders.

Bishop, MME. ANNA (RIVIERE), 1814–1884. Anglo-American singer, prominent in opera till 1868; married to Sir H. R. Bishop 1831, and to M. Schultz of N. Y. 1858.

Bishop, SIR HENRY ROWLEY, 1786–1855. English musician, long conductor at Covent Garden and Drury Lane theaters; knighted 1842; prof. Oxford 1848; composer of many operas. One of them, *Clari*, 1823, contains "Home, Sweet Home."

Bishop, MRS. ISABELLA L. (BIRD). English traveler. *Hawaiian Archipelago*, 1875; *Rocky Mountains*, 1879; *Japan*, 1881; *Golden Chersonese*, 1883; *Thibetans*, 1895.

Bishop, JOEL PRENTISS, LL.D., b. 1814. American legal writer. *Marriage and Divorce*, 1852; *Criminal Law*, 1865; *Law of Contracts*, 1878; *Non-Contract Law*, 1889.

Bishop, WILLIAM HENRY, b. 1847. American novelist: prof. Yale 1893. *Detmold*, 1879; *House of a Merchant Prince*, 1882; *Old Mexico*, 1883; *Choy Susan*, 1884; *The Golden Justice*, 1886: *A Pound of Cure*, 1894.

Bishop's-Cap. *Mitella diphylla.* N. American plant of the Saxifrage family.

Bishop's Ring. Ring of 10° or 15° radius, observed 1883 about the sun daily, first by Sereno, Bp. of the Sandwich Islands, and explained as a diffraction phenomenon caused by the vapor and dust from the Krakatoa eruption.

Bismarck-Schönhausen, OTTO EDUARD LEOPOLD, PRINCE VON, b. 1815. German statesman, to whose energetic policy the restoration of the empire, under Prussian leadership, is chiefly due. He entered the diplomatic service of Prussia 1851; became Minister of Foreign Affairs 1862, and count 1865; brought about union of Schleswig-Holstein with Prussia 1866; was chief author of measures connected with war of 1866, tending to the unification of Germany; chancellor of N. German Confederation and pres. Federal Council 1867; foreign minister 1868; accompanied the king in the campaign against France 1870; dictated terms of peace and saw William crowned at Versailles; was made chancellor of the empire and prince. A conflict with the Pope followed, in which he adopted measures from many of which he afterward receded. He sought to preserve peace by keeping the army on a war footing, and to meet the Socialistic movement by a system of State Socialism. He resigned the chancellorship, March 1890, and since then has repeatedly been the object of enthusiastic popular demonstrations.

Bismarck Brown. $C_{18}H_{15}N_5Cl_2$. Triamidoazobenzene hydrochloride. Prepared by the action of nitrous acid upon metaphenylenediamine. Brown powder, soluble in water, the common aniline brown of trade.

Bismuth. Bi. At. Wt., 208.9, first described by Basil Valentine. Hydrochloric acid does not act upon it readily; concentrated sulphuric acid dissolves it, so also does nitric acid.

Its chief use is for the manufacture of pharmaceutical preparations. It is also used in making fusible metals. Its subcarbonate and subnitrate are used in medicine, in dyspepsia, to relieve nausea, as astringents in all forms of diarrhœa, and dusting powders. See BISMUTH, METALLURGY OF.

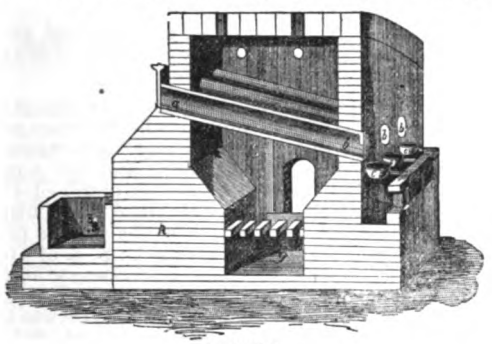
Bismuth Basic Nitrate. Subnitrate, made by treating the compound $Bi(NO_3)_3$ with water, its composition varying according to the conditions under which it is formed. It is used as a cosmetic, and in medicine as a remedy for dysentery and cholera. The French army uses ab. 1,250 kilos per annum.

Bismuth Dichloride. Bi_2Cl_4. Made by treating bismuth trichloride with hydrogen at 300°.

Bismuth Dioxide. Bi_2O_2. Brown precipitate formed by adding potassium hydroxide to a solution of bismuth chloride and stannous chloride.

Bismuth Hydroxide. $Bi(OH)_3$. White amorphous powder, obtained by precipitating a bismuth salt with cold caustic soda or ammonia. If it be heated to 100° is converted into BiO.OH.

Bismuth, METALLURGY OF. Principal ore is native bismuth, found abundantly in the Schneeberg District of Saxony, Queensland, and New South Wales. It occurs in considerable quantity in cobalt ores, and extracted from the residues of the German smalt works. First mentioned by Valentinus 15th century. Agricola,1489, mentions "Bisemethum," German Wismuth, Wiesematte, "beautiful meadows" from appearance of crystals; as late as 1600 it was confounded with antimony, and up to 1675 not distinguished clearly from tin. Metallurgy of bismuth is very simple, its easy fusibility allowing it to be



Bismuth.

melted away from the earthy matter of its ores. The ore is put into iron tubes set at an angle and heated to ab. 300° C. The ore is stirred, and the metal runs out and collects in an outer pot. This impure metal contains lead, nickel, copper, arsenic, iron, etc., and is purified by careful liquation on a hot iron plate, or by melting in a crucible with saltpeter and stirring with a stick of wood. Sometimes the ore itself is mixed with fluxes and run down in crucibles, adding metallic iron to neutralize any sulphur in the ore. During the cupellation of lead for silver, the bismuth present is oxidized with the last of the lead. The last parts of litharge are treated for bismuth at Freiberg by dissolving in muriatic acid, diluting, collecting the precipitated oxychloride of bismuth, and smelting it in crucibles with charcoal, silica and soda.

Commercial bismuth is produced only in England, from Australian ores, and in Germany. The yearly production is ab. 50 tons, and selling price $1.50 per lb. It is sold in bars of 25 to 50 lbs., and generally averages over 99 per cent pure, the rest being copper, silver, arsenic, antimony and iron. The pure metal has a specific gravity 9.8, melting point 268° C., boils between 1,050° and 1,400° C., specific heat 0.0308, conductivity for heat 18, for electricity 12 (silver being 1,000). The color is white with a reddish-violet tint. It can be cut into a shaving by a knife, but is neither malleable nor ductile. The principal uses are for easily fusible alloys, clichés and stereotype metal. Their composition is as follows:

		Bismuth.	Lead.	Tin.	Cadmium.	Melting Point.
Newton's	Alloy	8	5	3	—	94.5° C.
Rose's	"	2	1	1	—	93.8° C.
Lichtenberg's	"	5	3	2	—	91.6° C.
Wood's	"	4	2	1	—	71.0° C.
Lipowitz's	"	15	8	4	3	60.0° C.

An addition of mercury lowers these melting points still further. Some other useful alloys are:

	Bismuth.	Tin.	Lead.	Mercury.
Soft solder for pewter	1	2	1	—
Stereotype metal	5	2	3	—
For filling teeth	45	17	29	9
Silvering inside of glass globes	20	—	—	80

Bismuth Nitrate, TRINITRATE. $Bi(NO_3)_3 3H_2O$. Obtained in large triclinic prisms by dissolving the metal in nitric acid, and evaporating. The solution corrodes paper. It is deliquescent.

Bismuth Oxychloride. BiOCl. White powder obtained by treating bismuth trichloride with a large quantity of water, is soluble in hydrochloric acid. It is used as a cosmetic (pearl white).

Bismuth Pentoxide. Bi_2O_5. Formed by oxidizing the trioxide with chlorine in an alkaline solution. It is a brown powder, and is very unstable.

Bismuth Subnitrate. See BISMUTH BASIC NITRATE.

Bismuth Trichloride. $BiCl_3$. Granular white mass, easily fusible and volatile, made by treating bismuth with chlorine; or the trioxide with hydrochloric acid.

Bismuth Trioxide. Bi_2O_3. Yellow powder formed by burning bismuth in the air.

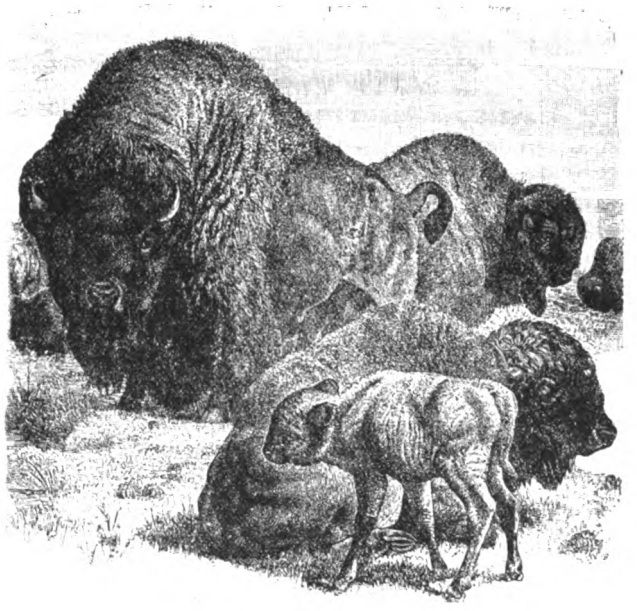
Bismuth Trisulphide. Bi_2S_3. Blackish-brown precipitate obtained by passing hydrogen sulphide into a solution of a bismuth salt. It is soluble in hydrochloric (concentrated) and nitric acids.

Bismuthic Acid. $HBiO_3$. Obtained by passing chlorine into a boiling solution of caustic potash containing bismuth trioxide in suspension. It is a red powder.

Bismuthinite. Bi_2S_3. Compound of bismuth and sulphur, widely distributed.

Bismuthyl Salts. Derived from the compound BiO.OH; *e.g.*, BiO.OK.

Bison. Subgenus, distinguished from Ox in the broader forehead, upwardly curved horns, springing in front of frontoparietal ridge of skull, shoulders higher than rump, a woolly mane and beard beneath the chin. The European Bison has one, and the American two, more pairs of ribs than the Ox, which has thirteen pairs. The American Bison is also shorter, but



American Buffalo (*Bison Americanus*).

with higher, heavier shoulders and more slender rump than the European. A ht. of 7 ft. and length of 13 has been recorded of the European Aurochs. The American "Buffalo" of an equal extreme ht. does not exceed 10 ft. in length, and a weight of 2,000 lbs. The cows are about four-fifths as large. The sexes pair in the autumn and separate in the spring, when the female retires to calve. At this time the dense fur is in process of shedding. A few years back, when large herds roamed over the prairies, migration with the seasons was practiced, but now the animal is restricted to isolated localities in the Eastern Rocky Mt. region, even into Canada. In the Yellowstone Park the Government has taken measures for their preservation. They are fond of wallowing in mud-holes, are capable of domestication, if taken young, and the flesh is good food at certain seasons. The male Aurochs has been known to live 40 or 50 years. See BOVIDÆ.

Bissell, EDWIN CONE, D.D., b. 1832. Prof. Hartford Theol. Sem. 1881, and Chicago 1892. *Historic Origin of the Bible*, 1873; *Pentateuch*, 1885; *BiblicalAntiquities*, 1888; *Hebrew Grammar*, 1891.

Bissell, WILSON SHANNON, b. 1847. U. S. Postmaster-General 1893-95.

Bissell Truck. See BOGIE. Form of truck or bogie for supporting the front end of the locomotive; patented 1851, 1858, and 1864 by Levi Bissell. It had only two wheels, and the weight of the engine rested upon a plate upon which it might slide sidewise when the engine was running on a curve. The center of the lateral motion was a pin back of the point where the weight was borne over the axles. It made the wheel-base more flexible for sharp curves.

Bissextile Year. Every fourth year, according to the Julian calendar, containing 366 days; so called because the additional day was obtained by counting twice the sixth day before the kalends of March.

Bistoury. Long, narrow surgical knife, with either a blunt or sharp point, straight or curved like a scythe.

Bites OF ANIMALS, INSECTS AND REPTILES. Differ little from ordinary wounds save when inflicted by rabid animals, those affected with farcy or glanders, poisonous snakes or lizards, or insects which deposit irritating substances or the eggs of parasites, or inoculate decomposing animal matters, upon which they have been feeding. All bites of animals or reptiles should be as soon as possible sucked by one whose mouth is free from cracks or raw spots, enlarged by free cutting with a sharp knife, cauterized with a hot iron, acids, silver nitrate, etc., and the part when possible surrounded by a cord on the body side of the injury to prevent the absorption of the poison into the general circulation. Alcohol or ammonia must also be given to sustain the action of the heart, but not in the colossal doses ordinarily used, which by themselves prove fatal as often as the poison they are used to counteract. The only poisonous reptiles of the U. S. are the rattlesnake, moccasin, that variety known as the "cotton-mouth" being the most dangerous, the copperhead, and the Gila monsters [species of *Heloderma*]. Insect bites or stings are rarely of much importance save when their number is so great as to cause a great deal of irritation (although in Japan a febrile disorder is said to be caused by a native insect), and are easily relieved by applications of solutions of alkalies or carbolic acid. Mosquitoes unquestionably introduce the embryos of a parasite, the *Filaria hominis*, which give rise to the disease Chyluria. Bites of flies which have been feeding upon decayed animal matters sometimes communicate malignant pustule. The tarantula has been accused of causing a form of dancing mania prevalent during the Middle Ages, but, while somewhat painful, they were little more than an excuse for the hysterical to be attacked by the epidemic. Ants deposit a small amount of formic acid, and have sometimes been applied to the skin in large numbers to excite counter-irritation. It is a possibility that disease may be communicated by the bites of insects.

Bleeding. Abstraction of blood by opening an artery or vein, cupping or leeches, formerly employed in every imaginable form of disease, but now abandoned save in cases in which there are signs of marked congestion which demands immediate relief, and in the treatment of acute localized inflammations, as of the eye, ear, joints, etc. Leeching, in these latter conditions, is the method most commonly used.

Bithynia. In Asia Minor, bordering on the Black Sea and Sea of Marmora; originally peopled by Thracian tribes; incorporated with Persian empire under Cyrus 543 B.C.; independent from ab. 440 to 74 B.C., when it became a province of Rome; conquered by Turks 1298.

Bitonto. Town of s. Italy, where the Austrians were defeated, May 25, 1734, by Don Carlos, who gained the Two Sicilies thereby. Pop. 27,000.

Bitter Almond Oil. See BENZALDEHYDE.

Bitter Cress. Species of *Cardamine*, genus of the Mustard family.

Bitter Cup. See QUASSIA.

Bitter, KARL THEODORE FRANCIS, b. 1867, in Vienna. Sculptor, resident in U. S. since 1889. *The Four Elements*, at the Columbian Exposition; Astor Memorial bronze doors of Trinity Church, N. Y.

Bittern. Bird of Heron family (*Ardeidæ*) and genus *Botaurus*, world-wide in distribution. The genus is characterized by the presence of two pairs of powder-down patches, ten short, somewhat soft, tail feathers, outer toe shorter than the inner, and with but slightly curved claws. *B. lentiginosus*, the American Bittern, is ochraceous in color, with dark grayish stripes and mottling, and brownish freckling, the lower parts pale buff. They are 2 or 3 ft. long, with a pointed bill 3 in. long. The Least Bittern (*B. exilis*) is scarcely more than a foot long, and the females and young are unlike the adult male, which is black on back. Bitterns frequent swamps, feeding on frogs and fishes. They are shy and nocturnal. The booming, croaking, or gurgling sound they make has given them the name of Stake Driver.

Bitter-Root. *Lewisia rediviva*. Herb of the natural family *Portulacaceæ*, having a large farinaceous root, native of n. w. N. America. Name also given in s. Africa to *Gerrardanthus macrorhiza*, a plant of the Gourd family.

Bitter Root Mountains. Long winding succession of ranges which separate the Jefferson Fork of the Missouri and Clark's Fork of the Columbia from Salmon and Clearwater Rs. The boundary between Montana and Idaho follows its crest.

Bittersweet. Climbing plant of the Potato family, native of Europe, *Solanum Dulcamara*. Also, in N. America, a vine of the natural family *Celastraceæ*, the *Celastrus scandens*, known also as Waxwork, Shrubby Bittersweet, and Staff-tree.

Solanum Dulcamara.

Bitter-Weed. See HOG-WEED.

Bitts. Large pieces of timber in the forepart of a ship, round which the cables are fastened when the ship is at anchor.

Bitumen. Hydrocarbonaceous substances like petroleum, mineral tar, maltha, and asphaltum, ranging in consistency from a fluid to a solid. ASPHALT (q.v.) is a bitumen solid at ordinary temperatures.

Bituminous Coal. Commercial rather than scientific name, covering varieties of coal that lie between anthracite and brown coal, but differ considerably in composition and properties. They contain no bitumen, and are named from the fact that from them products can be obtained closely resembling or identical with those obtained from bitumen by distillation. By far the larger part of the world's production of coal is bituminous. The fields of the U. S. e. of the Rocky Mts. cover nearly 200,000 sq. m., and fields nearly as large are supposed to exist w. of the mts. The coal area of Great Britain is given as 11,900 sq. m. In 1893 the mines of the U. S. produced over 125,000,000 tons, and of England, 164,325,975 tons. See COAL.

Bitzius, ALBERT ("JEREMIAS GOTTHELF"), 1797–1854. Swiss pastor, author of popular moral tales. *Mirror of Peasants*, 1836; *Grandma Katy*, 1848; *Uli*, 1850.

Biuret. $C_2H_5N_3O_2$. Mpt. 190° C. White crystalline substance obtained by heating urea; soluble in water, regarded as the amide of the hypothetical allophanic acid, $NH{\cdot}^{CO.NH_2}_{COOH}$.

Bivalent. Capable of replacing two hydrogen atoms in a chemical compound.

Bivalve. Shells composed of two halves or pieces. *Lamellibranchiata*.

Bivium. Two rays of the star-fish, on each side of the madreporic tubercle.

Bivoltine. Producing two broods per year.

Bixaceæ. Natural order of flowering plants of the class *Angiospermæ*, and sub-class *Dicotyledones*, comprising 36 genera and ab. 180 species, distributed throughout the warmer regions of the earth, especially the tropics.

Bixin. $C_{28}H_{34}O_5$. Yellow coloring matter obtained from the fruit of the *Bixa orellana*. Known in commerce as ANNATTO (q.v.). Constitution unknown.

Bizet, GEORGES (properly ALEXANDRE CESAR LEOPOLD), 1838–1875. French opera composer, pupil and son-in-law of Halévy. His greatest work is *Carmen*, 1875.

Bjerregaard, HENRIK ANKER, 1792–1842. Norwegian poet and dramatist.

Björnson, BJÖRNSTJERNE, b. 1832. Norwegian novelist and dramatist of the first rank. *Synnove Solbakken*, 1857; *Arne*, 1858; *Fisher Lass*, 1868. Among his plays are *Sigurd Slembe*, 1862; *Maria Stuart*, 1864; *Bankruptcy*, 1875; *The King*, 1879. Since 1874 he has led the advanced thought of Norway.

Black, JEREMIAH SULLIVAN, 1810–1883. Pa. Dist. Judge 1842–51; Pa. Sup. Court Judge 1851–57; U. S. Atty-Gen. 1857–60; U. S. Sec. of State, 1860–61.

Black, JOSEPH. 1728–1799. British chemist; investigated

Joseph Black.

carbonic acid and latent heat. Prof. Glasgow 1756, Edinburgh 1766. *Lectures*, 2 vols., 1803.

Black, WILLIAM, b.1841. Scottish novelist, noted for his descriptions of Highland scenery. *In Silk Attire*, 1869; *Kilmeny*, 1870; *Adventures of a Phaeton*, 1872; *A Princess of Thule*, 1873; *Madcap Violet*, 1876; *Macleod of Dare*, 1878; *In Far Lochaber*, 1888.

Black Alder. *Ilex verticillata.* Shrub of the Holly family, native of the e. U. S., known also as Winterberry.

Black Ash. Mixture of sodium carbonate and calcium sulphide, obtained in Le Blanc process for SODIUM CARBONATE (q.v.).

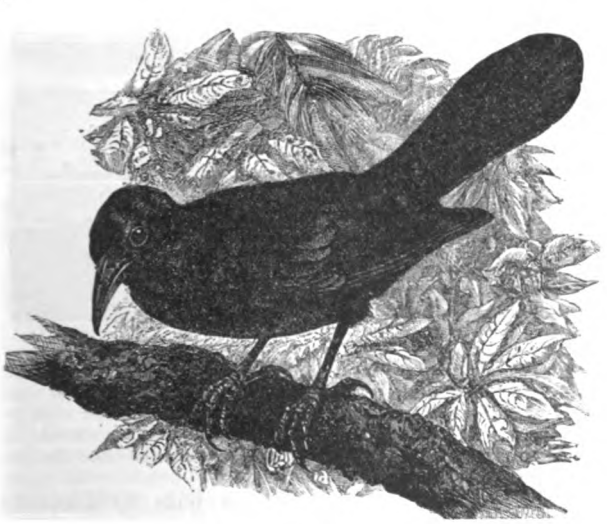
Black-Band. Carbonaceous and shaly deposit of earthy spathic iron ore, frequently associated with coal-beds, and in some places, as in England and Ohio, a valuable ore.

Blackbeard, d. 1718. Pirate from Bristol, whose real name was Edward Teach. He ran his wild career in 1717–18, operating chiefly near the W. Indies and Bermudas, and on the Carolina coast.

Blackberry. In N. America, certain species of the genus *Rubus*, bearing edible fruits.

Blackberry Lily. *Belamcanda Chinensis.* Plant of the Iris family, whose fruit much resembles the blackberry.

Blackbird. See DENTIROSTRES. 1. European bird, *Turdus merula*, of the Thrush family. The male is uniformly black, the female brown, and the bill yellow. It is shy, solitary, nests in March, and has two broods during the season. The nest is plastered inside with mud; four or six blue eggs, speckled with black, are laid. The bird feeds mainly on insects.



Blackbird (*Chalcophanes quiscalus*).

It is a mocking bird, but not so good a songster as the song-thrush. In confinement it can be taught. In the wild state it migrates in large flocks, wintering in s. Europe and n. Africa. 2. American, sometimes termed a Grackle, of the *Icteridæ*. The Crow-blackbird or Purple Grackle (*Quiscalus*) is restricted to the e. of the Rockies, the Blue-headed Grackle is confined w. of the Mississippi, while the Rusty Grackle (*Scolecophagus*) pervades almost the whole continent. These birds are omnivorous, and it is a mooted question whether the good they do in destroying insects is not counterbalanced by the corn and other grain eaten at seed-time and harvest.

Black Bulb in vacuo. See ARAGO-DAVY ACTINOMETER.

Blackburn. Manufacturing borough of Lancashire, Eng. Pop., 1891, 120,064.

Blackburn University. Carlinville, Ill.; organized by Presbyterians 1864. It has 12 instructors and ab. 100 students.

Black-Damp. Carbonic acid gas, when accumulated in pits, or resulting from an explosion of fire-damp.

Black Death. Plague which ravaged Europe 1347–52. It appeared in England 1361 and 1368, though under a different name. One-fourth of the population of Europe, or 25 millions, is estimated to have died by these epidemics.

Black Drink. *Ilex vomitoria.* Small tree of the Holly family, native of s. e. N. America. An infusion of the leaves is used by Indians as Cassena Tea.

Black-Drop. Distortion of the apparent disks of Mercury and Venus as they approach the Sun's limb when transits occur.

Black Flux. Mixture of potassium carbonate and charcoal, obtained by deflagrating argol with niter. It is used in testing for arsenic and in assaying ores.

Black Friday. May 11, 1866, when the suspension of Overend, Gurney & Co., London, caused a commercial panic.

Black-Grass. *Juncus Gerardi.* Grass-like plant of natural family *Gesneraceæ*, native of salt-meadows.

Black-Gum. Tupelo tree found in parts of the e. U. S.; *Nyssa multiflora*, a member of the Dogwood family.

Black Hawk, 1767–1838. Indian chief Sac and Fox tribes, leader in a war, 1832, against U. S.

Blackheath. S. of London. The followers of Wat Tyler gathered here June 12, 1381, and those of Jack Cade 1450; here, too, the Cornish insurgents were defeated June 22, 1497.

Black Hills. Elliptical group of mountains in s. w. Dakota and n. e. Wyoming. The interior is composed of Archæan rocks around which are upturned stratified beds. Elevation 6,000 to 7,000 ft.

Black-Hole. Dungeon in Calcutta, 18 ft. sq., in which Suraja Dowlah confined 146 English prisoners, June 20, 1756, 123 of whom died during the night.

Blackie, JOHN STUART, 1809–1895. Scottish poet and essayist; Prof. of Greek, Univ. Edinburgh, 1852–82; translator of *Faust*, 1834; *Æschylus*, 1850; and the *Iliad*, 1866. *Atheism*, 1877; *Life of Burns*, 1887.

Blacking-Plant. *Hibiscus Rosa-Sinensis.* Shrub of the Mallow family, native of China, where a pigment is derived from the flowers and used for blacking the eyebrows, etc.

Black-Jack. ZnS. English miner's name for zinc-blende.

Black-Jack. In the Middle and Southern States common name for Oak, *Quercus nigra.*

Black-Lead. Graphite, used for making so-called lead-pencils and crucibles. See PLUMBAGO.

Blacklock, THOMAS, D.D., 1721–1791. Scottish poet, blind from infancy.

Black Monday. Easter Monday, April 14, 1360, when Edward III. with his army lay before Paris; the day was dark with mist, and the hail, wind, and cold so bitter that many men and horses died.

Blackmore, SIR RICHARD, ab.1650–1729. English poet. *Creation*, 1712.

Blackmore, RICHARD DODDRIDGE, b. 1825. English novelist; translator of Virgil's *Georgics*, 1862–71. *Lorna Doone*, pub. 1869, attained its great fame some years later. *Clara Vaughan*, 1864; *Maid of Sker*, 1872; *Erema*, 1877; *Springhaven*, 1887; *Kit and Kitty*, 1890; *Perlycross*, 1894.

Black Prince, EDWARD, PRINCE OF WALES, 1330–1376. Son of Edward III. and father of Richard II. He fought at Crecy 1346; defeated French at Poitiers 1356, and took King John prisoner; restored Peter the Cruel of Castile to his throne 1367.

Black River. Bed of dark Limestone in the Ordovician of N. Y. below the Trenton.

Black Rood. Brought into Scotland 1067; twice taken by the English, and kept, after 1346, at Durham Cathedral; lost at the Reformation. Said to include a piece of the True Cross.

Black Sea. Inland sea separating Europe and Asia, connected with the Mediterranean by the Bosphorus, Sea of Marmora and Dardanelles. It receives the waters of numerous

large rivers from the north, among them the Danube, Dnieper, and Don. Area 172,000 sq. m.

Blackstone, Sir William, 1723–1780. Prof. Oxford 1758, Solicitor-General 1763, Common Pleas Judge 1770. *Commentaries on the Laws of England*, 1765–69.

Blackthorn. *Prunus spinosa.* Small tree of the Plum family, native of Europe, introduced into N. America; known also as Sloe.

Bladder. The somewhat ovoid receptacle for the urine which, when empty, lies deep in the pelvis, and when full rises a varying extent above the pubis, having a normal capacity in males of ab. one pint but somewhat less in females. It receives the urine from the kidneys, discharges it through the urethra, and consists of a layer of involuntary muscular fibers, outside which is the peritonæum and within a layer of mucous membrane.

Bladder-Fern. Species of the genus *Cystopteris.*

Bladder-Ketmia. *Hibiscus Trionum.* Plant of the Mallow family, native of Europe, but widely dispersed as a weed.

Bladder-Nut. Species of *Staphylea*, shrubs of the Maple family with inflated pods, natives of the northern hemisphere.

Staphylea pinnata.

Bladder-pod. Species of *Vesicaria*, plants of the natural family *Cruciferæ*, mostly natives of the Old World. Also, *Lesquerella*, a similar genus in America.

Bladderworts. Aquatic plants of the genus *Utricularia*, natural family *Lentibulariaceæ*, bearing small sacs, or ascidia, within which minute aquatic animals are entrapped.

Bladder-Wrack. See Rockweed.

Blade. Expanded portion of a leaf or petal; also called lamina.

Blades, William, 1824–1890. English bibliographer. *Life and Typography of William Caxton*, 1861–63.

Blaikie, William Garden, D.D., LL.D., b. 1820. Prof. New Coll., Edinburgh, 1868; prolific author. *Better Days for Working People*, 1863; *Heads and Hands*, 1865; *Preachers of Scotland*, 1888.

Blaine, James Gillespie, LL.D., 1830–1893. M. C. 1862–76; Speaker 1869–75; U. S. Senator from Me. 1876; Sec. of State 1881 and 1889–92; a candidate for Presidential nomination 1876 and 1880, and Republican candidate for the Presidency 1884; long the most popular leader of his party.

Blair, Austin, 1818–1894. Gov. of Michigan 1861–65; M. C. 1867–73.

Blair, Hugh, D.D., 1718–1800. Prof. Univ. Edinburgh 1760–83. His *Sermons*, 5 vols., 1777–1801, were noted for elegance, and his *Rhetoric*, 1783, was long a text-book.

Blair, Montgomery, 1813–1883. U. S. Postmaster-Gen. 1861–64.—His brother, Francis Preston, 1821–1875, was M. C. from Mo. 1857–63, major-gen. of U. S. Vols. 1862–65, and Senator 1871–73.

Blair, Robert, 1699–1746. Scottish poet. *The Grave*, 1743.

Blake, Robert, 1598–1657. British admiral 1652. He defeated the Dutch fleet under Van Tromp 1652–53, humbled Tunis 1654, and in 1657 entered the harbor of Santa Cruz and inflicted heavy loss on Spain.

Blake, William, 1757–1827. English engraver, designer, and poet. He illustrated his own poems, Job, Dante, and Blair's *Grave;* his drawings display extraordinary imaginative power. *Book of Theil*, 1789; *Songs of Innocence and of Experience*, 1789–94.

Blakelock, Ralph Albert, b. 1847. American landscape painter.

Blamire, Susanna, 1747–1794. Scottish lyric poet, b. in England. Her songs were collected 1842.

Blanc, Jean Joseph Louis, 1813–1882. French historian and socialist, prominent in public affairs 1848. *Organization of Labor*, 1840; *History of Ten Years*, 1841–44; *French Revolution*, 12 vols., 1849–62.

Blanc, Mme. French journalist and translator, who writes as "Th. Bentzon."

Blanc, Mont. Highest mountain of Europe, a peak of the Pennine Alps, rising above the Vale of Chamouni. Altitude 15,780 ft.

Blanca Peak. Highest summit of the Sangre de Cristo range in Colorado. Altitude 14,464 ft.

Blanchard, Auguste-Thomas-Marie, b. 1819. French line engraver who has devoted himself almost exclusively to the reproduction, on copper, of works of modern painters. His best-known plates are *Gabriel*, after Delaroche; *Faust and Marguerite*, after Ary Scheffer; and *Vintage at Rome*, after Alma Tadema.

Blanchard Lathe. Wood-working tool for producing irregular forms in wood, such as ax-handles, gun-stocks, oars, etc. A blank or piece of work to be operated on is held between centers and slowly revolves. A rapidly revolving cutter is driven by a belt, the cutter being borne upon a frame or carriage. The frame is held by a weight against the surface of a former or pattern, and the revolving cutter removes material from the blank just as the profile of the pattern allows it to approach or compels it to recede from the axis of the blank. The pattern and the blank revolve together, so that an irregular transverse section is reproduced, as well as a longitudinal profile. See Lathe.

Blanche of Castile, 1187–1252. Queen of Louis VIII. of France; regent 1226; mother of St. Louis.

Bland, Richard Parks, b. 1835. M. C. from Mo. since 1873: most prominent advocate of free silver.

Blank Verse. Metrical but unrhymed; introduced in Italy ab. 1500, thence in England 1547, and later in Germany; familiar since its most illustrious example, *Paradise Lost*, 1667.

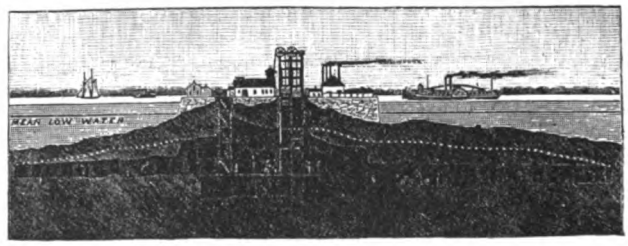
Blanqui, Jerome Adolphe, 1798–1854. French economist, pupil of J. B. Say, prof. in Paris 1825. *Hist. Political Economy in Europe*, 1837–8.—His brother, Louis Auguste, 1805–1881, a Communist leader, was long in prison.

Blashfield, Edwin Howland, b. 1848. American subject painter. His colossal picture, *Christmas Bells*, was exhibited at the Columbian Fair 1893.

Blasphemy. Malicious reviling of God or religion; accounted a crime because believed to injure public morals, but rarely punished.

Blast-Engine. Required in metallurgical operations to force necessary air into the furnace or converting vessel to effect chemical reactions; usually of the "steeple" type, inverted vertical engines, with fly-wheels below and the air-cylinder above. The steam valves are most frequently of the poppet type, operated usually by cams. The fly-wheels are usually in pairs. Some of the older engines are horizontal, and there are a very few beam engines. The pressure of the air averages between 8 and 12 lbs. per sq. inch in blast furnace practice, and from 30 to 40 lbs. in steel practice. The air-valves are most often of the flap type, seating upon gratings. See Blower.

Blasting. Method of quarrying stone in which drill-holes are made and explosives fired to detach the blocks. Gunpowder is preferred, as dynamite tends to act quickly and break the stone in many directions. The charge should be such as merely



Section Diagram of Hell Gate Tunnels.

to detach the block without shattering it. The volume of rock loosened by a blast is approximately proportional to the charge, and the number of pounds of powder in small blasts should be about one-thirtieth of the cube of the shortest distance in feet from the charge to the surface of the rock.

Blastocolla. Balsam produced on buds by glandular hairs.

Blastoderm. Flattened layer of cells which develops in a fecundated ovum, from which the embryo is formed, the remainder of the ovum furnishing material for its nourishment.

Blastodisc. Heap of protoplasm which has separated from a meroblastic ovum (as in Teleosts) at animal pole of egg. It undergoes total and sub-equal segmentation to form a blastodermic disc; sometimes called germinal disc both before and after segmentation.

Blastoidea. Palæozoic, fossil Echinoderms, with globose bodies, attached by slender stems. The summit of the calyx bears a "rosette," whose petals are transversely striated and longitudinally grooved, and bear a row of pinnulæ on each side; *e.g.*, the Pentremites.

Blastophore. Common connecting part between several cells that have resulted by the segmentation or cell division of a single cell, ultimately to be transformed into spermatozoa (as in a spermatogemma). The blastophoral part serves as a sort of placenta; it does not become transformed into a sperm; and it is believed by some theorists to represent the "female" part of the cell, by others the histogenic portion, a sort of polar globule.

Blastopore. Circular space of yolk-surface left uncovered at the vegetative pole of an egg during the spreading of the blastoderm, by epibole. Also the gastrula mouth or archistoma. This term is applied to structures not strictly homologous. (1) The primitive gastrula mouth (gastropore, archistome, gastrostome). (2) The yolk-area last exposed behind the neurenteric canal, and the postanal vesicle, of *Ichthyopsida*. (3) The yolk last inclosed in the egg of *Sauropsida*, separated by at least one structure (primitive groove) from the primitive blastopore. (The primitive groove is homologous with the second kind of blastopore.) (4) The Mammalian blastopore, a modified gastropore (blastopore of Van Beneden). It is believed that in most animals both the permanent mouth and anus are formed out of the blastopore, but the subject is yet obscure.

Blatchford, SAMUEL, LL.D., 1820–1893. U. S. Judge of s. dist. N. Y. 1867; Justice of U. S. Sup. Ct. 1882.

Blattidæ. Cursorial Orthoptera with flattened oval bodies, powerful spiny legs with five-jointed tarsi. The head is covered by the large prothoracic shield. The anterior wings constitute large wing-covers that overlap each other. Some female

Cockroaches (*Periplaneta orientalis*).

forms lack wings. They live on animal matter, avoid the light, and damage stored provisions. The Cockroach is the type.

Blavatsky, MME. HELENA PETROVNA (HAHN), 1831–1891. Theosophist; b. in Russia, she traveled extensively, and in 1875 started the Theosophical Society in N. Y. *Isis Unveiled*, 1877.

Blazing Star. In America, species of *Lacinavia*, a genus of *Compositæ;* also, *Chamælirium luteum*, an insignificant plant of the Lily family, known also as Devil's-Bit.

Bleaching. Process of whitening or removing color from various substances, especially fabrics. The most common bleaching agents are chlorine, sulphur dioxide, hydrogen dioxide, and potassium permanganate.

The various fibers of cotton, wool, silk, flax, hemp, jute, paper or grass differ in composition and behavior toward reagents, and each requires special method of treatment. The vegetable fibers, as a rule, are more tolerant of reagents than animal fibers. Cotton: the method employed depends upon the future use of the fabric. The "market bleach" is used to produce a pure white and is, 1st, lime boil or stew, in which the fabric is boiled in lime water or other alkali and then washed; 2d, "Souring," treatment with dilute hydrochloric or sulphuric acid (sp. gr. 1.01) and washed; 3d, "Soda Ash boiling," using 3 to 5 per cent soda ash and washed; 4th, "Chemicking," subjecting to a solution of bleaching powder of ¼° to 2° Tw., sp. gr. 1.001 to 1.010, and washed. These operations are repeated until the fabric is white. When the material is to be dyed a dark shade it is subjected to a simple bleach consisting of, 1st, alkali boil, 2d, souring and then washed. The various processes differ only in the alkali or acid used and involve special machinery. Among them are the Mather-Thomson and Lunge processes. In the Hermite process the chlorine is generated in the bleaching solution by the electrolysis of a solution of magnesium chloride. Flax and hemp are bleached by boiling in water, subjecting to steam, and then dried. Grass and straw like cotton, using weaker solutions. Straw for hats is treated with sulphurous acid. Feathers with potassium bi-chromate and nitric acid, and then washed in sulphurous acid; also by peroxide of hydrogen. Hair with aqua-regia or hydrogen peroxide. Jute: boiled with sodium silicate or carbonate, then with chloride of lime or sodium sulphite, soured, and washed. Linen: 1st, lime boil; 2d, sour; 3d, soap boil; 4th, wash; 5th, expose to sunlight; 6th, chemic, repeating until white; finally washing. Paper stock, like cotton. Silk: boil the raw silk in soap solution to remove the natural gum, wash, and then treat with sulphurous acid. Wool: 1st, subject to dilute alkali; 2d, washed; 3d, treated with sulphurous acid; 4th, washed and the operation repeated if necessary. It is finally blued to overcome the natural yellow tint. Sponges are bleached with potassium permanganate.

Bleaching Powder. Chloride of lime, $CaOCl_2$, made by passing chlorine into slaked lime. It is a white powder, soluble in water; when treated with an acid chlorine is evolved. It is used for bleaching linen and cotton goods and various other substances. It is also used as a disinfectant. It contains 36 to 38 per cent available chlorine, but deteriorates by keeping. It has been made as high as 43 per cent.

Bleeders. Persons who have a tendency to hæmorrhage, controlled with great difficulty, which may occur spontaneously or be the result of trifling injuries. This tendency is usually inherited, being transmitted oftener by the mother than by the father; it runs in families, often proves fatal, and is best relieved by digitalis and ergot.

Bleeding Host. See CHROMOGENIC BACTERIA.

Bleeding Piles. Within the anus; they sometimes cause slight hæmorrhage from it.

Bleek, FRIEDRICH, 1793–1859. German commentator, prof. at Bonn 1823. *Introduction to O. T.*, tr. 1869; *Apocalypse*, 1862, tr. 1875.—His son, WILHELM HEINRICH IMMANUEL, 1827–1875, lived at Cape Town from 1856, and wrote on the languages of s. Africa.

Blende. (1) Zinc-blende, Sphalerite, ZnS. Sulphide of zinc containing 67 per cent of the metal; widely distributed, frequently found with lead ores. Formerly regarded as worthless, but now extensively worked for zinc in many parts of the world. (2) By some German mineralogists several sulphides of non-metallic appearance have been included under this name.

Blenheim, BATTLE OF. Aug. 13, 1704; French and Bavarian army defeated by Germans and English under Prince Eugene and Marlborough, with loss of 22,000. The French and Germans name this battle from Hochstädt in Bavaria.

Blennerhasset, HARMAN, 1764–1831. Anglo-American, living 1798–1806 on Backus Isl. in the Ohio, near Parkersburg, W. Va.; involved in Burr's schemes, tried for treason 1807, and financially ruined.

Blessington, MARGARET GARDINER, COUNTESS OF (born POWER), 1789–1849. Irish novelist and traveler, resident from 1829 in Gore House, London. *Conversations with Lord Byron*, 1834.

Blewits. *Agaricus personatus.* An edible fungus.

Blicher, STEEN STEENSEN, 1782–1848. Danish story writer and lyric poet; translator of Ossian. His tales, collected in 4 vols., 1882, are pictures of life in Jutland.

Blight. Fungus diseases of plants.

Blimbing. *Averrhoa Bilimbi.* Small tree of the Oxalis family, cultivated in E. and W. Indies for its edible fruit.

Blind-Arcade. See BLIND-STORY.

Blind, EDUCATION OF. Books on this subject were pub. in Europe in 1646 and 1670, and discussed by Locke, Reid and Leibnitz, but the first school was founded at Paris 1784, and Great Britain, Russia, and other countries soon followed. Boston, 1829, had the first school in U. S., Dr. S. G. Howe starting the movement here. Most institutions have literary, musical and industrial departments. Books are printed in raised type and read with the fingers, modified alphabets being used. Musical and vocal talent is specially fostered, the blind making first-class teachers, performers and piano-tuners. They are also taught basket and broom making, and all textile industries.

Blind, KARL, b. 1820. German scholar and author, exiled 1849, and long resident in England.

Blind, MATHILDE ("CLAUDE LAKE"). English poet, step-

daughter of Karl; tr. of Strauss's *Old Faith and New*, 1873; *Tarantella*, 1884; *Mme. Roland*, 1886.

Blind-Fish. Five species of *Amblyopsidæ* are known; that from Mammoth Cave, Ky., is *Amblyopsis spelæus*. The eyes are rudimentary, the sense of hearing acute, the color bleached or undeveloped, the vent at the throat. They are viviparous, and closely related to the Top-minnows, which they resemble in the mouth. See HAPLOMI, AMBLYOPSIDÆ.

Blindman's Buff. Child's game played by any number, one of whom is blindfolded by a handkerchief tied over his eyes. The one who is blindfolded endeavors to catch and name one of the others, who then takes his place. The game dates from classical antiquity, and is known by a variety of names in Europe.

Blindness. Generally due to disease of the portion of the brain in which the optic nerve has its origin, to disease of or pressure upon the nerve between that point and the eye, inflammations of it or the retina, opacity in the lens (cataract), and injuries to or disease of the transparent tissues between the lens and the exterior.

Blind Spot. The point in the retina at which the optic nerve enters it and where the cellular elements necessary for vision are lacking. It is ab. 1.5 mm. in diameter, irregularly circular in outline, and lies to the nasal side of the center. The size and shape differ in different individuals.

Blind-Story (Opposed to Clere-Story). In architecture a story without windows, especially applied to the triforium of a church. It was often enriched with representations of window-frames, including cusps, tracery, etc.; and this enrichment, if continuous, is called a blind-arcade.

Blisters. Separation of the outer portion of the skin from the deeper, resulting in the collection of fluid between them, by the use of cantharides, ammonia, iodine, etc.; procedure adopted for the relief of pain, and to hasten the absorption of abnormal collections of fluid in the different cavities of the body; used principally in diseases of the eye and ear, rheumatism, neuralgia, pleurisy, and inflammations remote from the surface of the body. Also produced by burns.

Blite. Species of genus *Blitum*, natural family *Chenopodiaceæ*, natives of the northern hemisphere.

Blite, SEA. Herbs of the genus *Suæda*, natural family *Chenopodiaceæ*, natives of salt marshes and saline soils, of wide geographical distribution.

Blizzard. Strong, cold wind accompanied by snow or sleet, usually following suddenly after pleasant weather. The most notable recent examples in the e. U. S. occurred March, 1888 and Feb. 1895.

Blockade. Closing seaports of a belligerent so as to subject a neutral ship to capture and confiscation for violating a blockade—(1) Due notice must have been given. (2) It must be an effective as distinguished from a paper blockade. (3) The ship must attempt to enter or leave the port illegally.

Block and Fall. Combination of a rope passing over a sheave in a pulley-block overhead and around through a block which advances with the resistance to be moved, the fixed end of the rope being made fast at or near the fixed pulley-block. The hauling rope is the "fall." The power need be only one-half the resistance plus the allowances for friction. In a "compound purchase" the power need be only $\frac{\text{Resistance}}{\text{No. of sheaves in both blocks,}}$ or the denominator may be considered as the number of branches of the rope which support the weight.

Block-Books. Produced in Germany and the Netherlands during latter half of 15th century; printed entirely from wood-engravings, consisting principally of religious subjects with text, description, or commentary, engraved on the same block. The most important of these are *Apocalypsis*, *Dance of Death*, *Canticus Canticorum*, *Biblia Pauperum*, and *Ars Moriendi*.

Block Coal. Non-caking bituminous coal, mined extensively in Ohio and Indiana. It has a strongly-marked laminated structure, and breaks easily into large slabs or blocks. An Ohio coal from Briar Hill Mine has sp. gr. 1.28; water, 3.6; volatile combustible matter 32.58; fixed carbon 62.66; ash 1.16 per cent.

Blocking-Course. Projecting but unmolded course of stone introduced to mark a division in the wall of a building.

Block Island. Part of Rhode Island, in the Atlantic near entrance to Long Island Sound, 8 m. long, 2 to 5 m. wide.

Block-System. Method of running railway trains so that only one train may be on a given block or distance at the same time. For this purpose the route is divided into blocks and an operator stationed at each point of division, who signals the passage of each train to the operators on either side. After a train has entered upon a block, a danger-signal is raised and no other train is allowed to pass upon it until the news has been received of its departure from the block. The automatic block-system in which the signals are raised and lowered by the train itself with the help of electrical connections is by far the most reliable in preventing collisions.

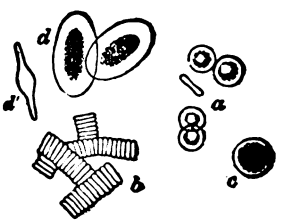
Blodget, LORIN, b. 1823. *Climatology of the U. S.*, 1857; *Resources of the U. S.*, 1864.

Bloede, GERTRUDE ("STUART STERNE"), b. 1845. German-American poet. *Angelo*, 1877; *Giorgio*, 1881; *Story of Two Lives*, 1892.

Blois. Ancient town of France, on the Loire, 35 m. s.w. of Orleans. In its castle Francis I. and other kings often dwelt, and the Duke of Guise was murdered 1588. Pop., 1891, 23,457.

Blomfield, CHARLES JAMES, D.D., 1786–1857. Bp. of Chester 1824, and of London 1828; editor of several Greek classics.—His *Life* was pub. 1863 by his son, ALFRED, D.D., b. 1833, Bp. suffragan of Colchester 1882.

Blood. Fluid which circulates through the heart, arteries, and veins, which absorbs the nutriment from the digested food, distributes it to the tissues of the body, and absorbs oxygen from the air in the lungs. It also takes up the waste products of the body, the carbonic acid passing out by the lungs and the solids by the urine, perspiration, and intestines. It is alkaline in reaction, of an average specific gravity of 1.055, bright red in the arteries, and dark red in the veins, the difference being due to the larger amount of oxygen in the former. Ab. 79 per cent consists of water, the rest of solids. It contains ab. 67 per cent of serum and 33 of corpuscles. The serum is the light yellow fluid which separates during the process of clotting, contains 90 per cent of water, 8 of albuminoids, and two of fat and salts. The corpuscles are of two kinds, the red in the proportion of about 700 to 1 of the white. In man the red corpuscles are about $\frac{1}{1200}$ of an inch thick and $\frac{1}{3200}$ in diameter, and are slightly thinner in the middle than at the edge. The white corpuscles are about one-third larger than the red, and exhibit what is known as amœboid movements. The total amount of blood in the human body in health equals about $\frac{1}{5}$ part of its entire weight. Cooked bullock's and sheep's blood are largely used as food by many races, especially the Germans and Italians, and at one time raw blood was used. Although it has considerable value as a food, twice that of milk, this practice was soon abandoned on account of the danger of contracting tapeworm. It is still used in cases of great exhaustion in nutrient enemata and by being injected into the tissues or abdominal cavity. Hæmoglobin, the coloring matter of the red corpuscles, contains considerable iron, is used when that metal is indicated, and is a very desirable form, as it is readily taken up and little liable to affect the digestion. It possesses slight nutritive value on account of the albuminoids found in it.



a, Human red blood-corpuscles as seen from the surface and from the side; *b*, human red blood-corpuscles forming *rouleaux*; *c*, white blood-corpuscle; *d*, red corpuscles of the frog's blood, seen from the surface; *d'*, the same as seen from the side.

Blood, AVENGER OF. In the East, the nearest kinsman of a slain person, whose duty it was to slay the slayer, whether intentional or not; restrained in Israel by the Cities of Refuge, which protected the innocent homicide.

Bloodberry. *Rivina humilis.* Small shrub of the natural family *Phytolaccaceæ*, native of Tropical America, bearing red berries.

Blood, COUNCIL OF. Extraordinary court, erected by Alva 1567 for the suppression of Protestantism in the Netherlands.

Blood-Flower. Species of the genus *Hæmanthus* of the Amaryllis family, natives of S. Africa, with showy red flowers.

Bloodletting. Procedure formerly extensively practiced with the mistaken intention of removing from the body substances assumed to cause disease, and also to diminish the amount of material upon which a disease would feed. It may be general, as when a vein is opened, or local, when cups or leeches are applied. It is now limited to those of strong constitution and to conditions in which there is congestion of organs, as in congestion of the brain, some forms of pneumonia, and inflammations of the eye or ear or in parts remote from the surface, and is generally done by cupping or leeching.

Blood-Poisoning. Condition due to absorption of poisonous animal substances by a wounded surface, or from an unhealthy wound or suppurating surface; usually manifested by enlargement of the glands, formation of abscesses, suppuration of joints, chills, sweating, fever, and great prostration. It often has a fatal issue.

Blood-Rain. Rain which owes its red color to the pres-

ence of minute fungi, previously present in the air as spore dust. See CHROMOGENIC BACTERIA.

Bloodroot. *Sanguinaria Canadensis.* N. American herb of the Poppy family, having a red juice and a showy white blossom.

Bloodstone. (1) Variety of uncrystallized quartz, feebly translucent, greenish, with dots of red jasper resembling blood, also called heliotrope. (2) Old name for red hematite.

Bloodwood. In E. Indies, *Lagerstrœmia Reginæ*, large tree of the family *Lythraceæ;* in Jamaica, *Gordonia hæmatoxylon*, tree of the Camellia family; in Australia, *Eucalyptus corymbosus;* in the s. Pacific, *Balogia lucida*, small tree of the Spurge family.

Bloodwort. Species of *Hæmodorum*, herbaceous plants of the natural family *Hæmodoraceæ*, natives of the Old World.

Bloody Assizes. Held by Jeffries in w. of England Aug. 1685; 300 were executed, 1,000 sent as slaves to the American plantations, and others imprisoned, for complicity in Monmouth's rebellion.

Bloody Statute. 31st Henry VIII., c. 14, which threatened death by hanging or burning to all deniers of the doctrine of transubstantiation.

Bloom. Thin layer of wax found on the surfaces of many fruits, and on the leaves of many succulent plants.

Bloomery. Furnace in which wrought iron is produced directly from the ore, instead of first converting the ore into pig iron. The ore and the fuel are brought in contact on the hearth of the furnace. The product is called a bloom. The Catalan forge and German bloomery are used in Europe and U. S. for the production of charcoal iron for making tool steel.

Bloomfield, ROBERT, 1766–1823. English poet. His *Farmer's Boy*, 1798, was long popular.

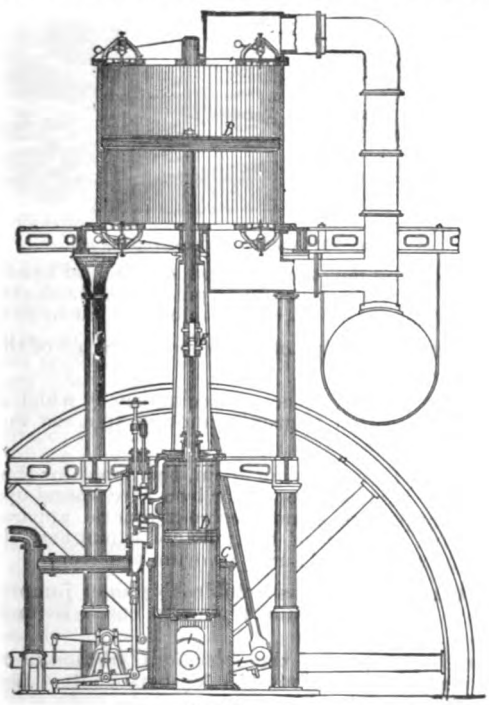
Bloomington. City of McLean co., Ill., near center of State. Pop., 1890, 20,484.

Blouet, PAUL ("MAX O'RELL"), b. 1848. Anglo-French humorist and lecturer, living in England. *John Bull and His Island*, 1883; *John Bull's Daughters*, 1884; *Jonathan and His Continent*, 1889. His books are usually written in French and tr. by his wife.

Blount, CHARLES, 1654–1693. English deist; tr. Philostratus's *Life of Apollonius of Tyana*, 1680.

Blow, JOHN, 1648–1708. Doctor of music, organist of Westminster Abbey.

Blower. Pieces of apparatus for displacing air, usually at low pressures. The term includes, 1: the fan or centrifugal blowers, in which a wheel with broad vanes or arms is made to

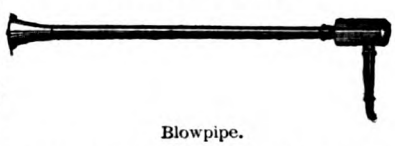


Blast Engine.

revolve rapidly inside a casing, so that the air between two arms is propelled radially by centrifugal force; 2, the rotary piston blowers, in which two parallel revolving shafts carry vanes of such shape that they are alternately sucking the air from outside the casing in which they revolve and forcing the air within the casing into the outlet; 3, the steam-jet blowers, acting on the Venturi principle of induced currents to draw the air, and to force it with a pressure due to the velocity of the jet of steam. The air-compressor or blowing engine is not usually classed as a blower, inasmuch as it delivers small quantities of air at high pressures. See BLAST ENGINE.

Blow-off Apparatus. In a steam boiler, fixtures arranged to permit a certain quantity of the water in the boiler to be discharged to waste or into drains. A pipe with a valve in it is attached to the lowest point in the boiler (to the mud-drum, if there is one), and by opening the valve, the solid matter which has settled at this point of most inactive circulation will be washed out by the flow to this point. Similarly also this valve will be used when the water in the boiler becomes too concentrated a solution of the soluble salts in the feed-water to be economically evaporated. Some of the waters which contain magnesia salts in solution make a floating scum on the surface of the water in the boiler. A surface blow-off apparatus would here be used, so that the water which escapes on opening the blow-off valve will be taken from the top instead of the bottom.

Blowpipe. Small tube with a convenient-sized mouthpiece at one end and a nozzle with a fine opening at the other. When it is to be used, the nozzle is placed near the flame the efficiency of which is to be increased, and air is blown into it. This gives the flame a greater intensity and enables the operator to give it any desired direction.



Blowpipe.

Blücher, GEBHARD LEBERECHT VON, 1742–1819. Prussian general, in chief command 1813; engaged at Lützen, Bautzen, and Haynau; made Prince of Wahlstadt 1814 for his victory of Katzbach; defeated at Ligny, June 16, 1815, but arrived on the field of Waterloo June 18 in time to decide the day, whose honors he shared with Wellington.

Bluebell. Various species of the genus *Campanula*, natives of the northern hemisphere.

Blueberry. In N. America, species of *Vaccinium*, shrubs of the natural family *Ericaceæ*, bearing delicious berries.

Bluebottle. *Centaurea Cyanus.* Plant of the natural family *Compositæ*, native of Europe but widely planted in gardens.

Blue-Curls. *Trichostema dichotomum.* N. American herb of the Mint family.

Bluefish. *Pomatomus saltatrix*, the "Skipjack," "Greenfish," or "Horsemackerel." It migrates in schools, n. in the spring, and s. into deeper water in the autumn. Its main food is the Menhaden, the schools of which it follows, but all smaller fishes are voraciously attacked, and often more killed than are eaten. Prof. Baird has estimated that in a single season more than 300,000,000,000 pounds of fish are thus destroyed. They weigh from 3 to 15 lbs., and are caught by trolling with a spoon-hook and line. When fresh, one of the most esteemed of our food fishes. See ACANTHOPTERI.

Blue-Flag. *Iris versicolor*, and other blue-flowered species of this genus.

Blue-Grass. *Poa pratensis*, or June grass. By far the best pasture grass grown in the U. S., naturalized from Europe in most parts, but also native in the n. portions. It reaches its best development on the rich limestone soils of Kentucky and the bottom lands of s. Ohio and Indiana, and thrives well in many portions of the prairie States. In nearly all parts of the n. U. S. it comes in spontaneously to the exclusion of other grasses on all soils that are fairly fertile. Another species, *P. compressa*, in N. Y. and New Eng., is of little value.

Blue-Gum. *Eucalyptus globulus.* Tall forest tree of the Myrtle family, native of Australia, now widely planted in warm temperate regions.

Blue-Hearts. Species of *Buchnera*, insignificant herbs of the natural family *Scrophulariaceæ.*

Blue John. Fluorite; so called by the miners of Derbyshire, Eng.

Blue Laws. For the punishment of moral and religious as distinguished from civil delinquencies; particularly, the supposed early laws of New Haven Colony, mainly invented by S. Peters, in his *History of Conn.*, 1781, a satire on Puritan severity.

Blue Lead. Large accumulations of auriferous gravel, the lower parts of which exhibit a characteristic bluish color, in portions of Plumas, Sierra, and Nevada counties, Cal.; so called from the hypothesis that the gravel all belonged to the

same lead, formed by the agency of an ancient river that flowed s. transverse to the course of the present streams. Though the observed facts have not confirmed the hypothesis in all respects, the name has been retained in common use.

Blue Light. See BENGAL LIGHT.

Blue Mountains. Group in n. e. Oregon, having a mean elevation of 8,000 to 10,000 ft.—Also, a range in New S. Wales.

Blue Nile. Large right-hand branch of the Nile, in n. e. Africa. It rises in the mountains of Abyssinia and flows n. w. to Khartoum, where it joins the White Nile.

Blue Pill, or BLUE MASS. Mercury intimately mixed with Honey of Rose, Glycyrrhiza and Althæa. Mercury constitutes one-third of the mass and partly changes to mercuric oxide after a time. Used for its sialagogic and alterative action. It excites the liver and pancreas.

Blue Printing. Process of reproducing drawings in which the lines appear white on a blue ground. The drawing is made on partially transparent paper or cloth with very black ink, and this is laid for a few minutes in sunlight on the sensitized paper, which has previously been prepared in a dark room. The action of the light causes chemical changes, and after the paper is washed with water the drawing appears in white lines. One of the formulas for preparing the sensitized paper is as follows: Dissolve 1½ oz. of red prussiate of potash in 8 oz. of water and keep it in a bottle; dissolve 1⅞ oz. of citrate of iron and ammonia in 8 oz. of water and keep it in a separate bottle; pour equal parts of these into an earthen dish, and wash the paper with a sponge soaked in the solution.

Blue Ridge. Easternmost member of the Appalachian Mt. system. It rises as a simple ridge in n. e. Pa., and runs s. w., with a gradually increasing height. In N. C. it broadens out into a complexity of ranges over 5,000 ft. in height, of which Mt. Mitchell, 6,707 ft., is the highest summit.

Blue Stone. See COPPER SULPHATE.

Bluetangle. See DANGLEBERRY.

Bluets. *Houstonia cærulea.* Blue-flowered herb of the Madder family, native in e. N. America.

Blue Vitriol. See COPPER SULPHATE.

Blueweed. *Echium vulgare.* Blue-flowered plant of the Borage family, native of Europe, but naturalized in America and becoming a bad weed. Known also as Viper's Bugloss.

Bluff. See POKER.

Blum, J. REINHARD. 1802–1883. Prof. Heidelberg; mineralogist. *Mineralreichs,* 1843.

Blume, KARL LUDWIG. 1796–1862. Dutch botanist. Author, with J. B. Fischer, of *Flora Javæ,* 1828; *Rumphia de Plantis Indiæ Orientalis,* 1835–37; *Flora Javæ,* 1858.

Blumhardt, CHRISTIAN GOTTLIEB, 1779–1838. German historian of missions, 5 vols., 1828–37.

Blunt, JOHN HENRY, D.D., 1823–1884. Anglican divine. *Household Theology,* 1865; *Annotated Book of Common Prayer,* 1866; *Dictionary of Doctrinal and Historical Theology,* 1870; *Dictionary of Sects, Heresies,* etc., 1874; *Annotated Bible,* 1878; *Reformation of the Ch. of England,* 1868–82.

Blunt, JOHN JAMES, 1794–1855. Prof. Univ. Cambridge 1839. *Reformation in England,* 1836; *Undesigned Coincidences in O. and N. T.,* 1847; *Ch. in First Three Centuries,* 1857.

Bluntschli, JOHANN KASPAR, 1808–1881. Swiss jurist, prof. at Zurich 1833 and Heidelberg 1859; author of sundry works on Swiss history and German law and politics.

Blytt, MATTHIAS NUMSEN, 1789–1862. Norwegian botanist, prof. in Christiana. *Norsk Flora,* 1847; *Norges Flora,* 1861.

Boabdil (ABU-ABDALLAH), d. ab. 1536. King of Granada 1481; conquered by Ferdinand of Aragon 1491; withdrew to Africa 1493.

Boa Constrictor. See PEROPODA and AGLYPHODONTA.

Boadicea, d. 62. British queen who fought against the Romans, slew about 70,000, was overcome by Suetonius and committed suicide.

Boar. Ungulate mammal of the *Suidæ* family. The wild boar, *Sus scorfa,* is native to the Old World, while those of the western hemisphere are supposed to have descended from domesticated stock. Name also applied to the male of swine.

Board, ACADEMIC. Body of officers, comprising the Supt. of U. S. Military Academy and heads of departments of instruction, on whom certain powers and duties relating to the academy are conferred by law.

Boardman, GEORGE DANA, 1801–1831. Baptist missionary to Burmah 1825, "apostle of the Karens."—His son and namesake, b. 1828, pastor in Phila., 1864–94, has pub. many sermons, lectures, etc.

Board Measure. Its unit is a board one inch thick and one sq. foot in area. The number of feet board measure in a stick of timber is twelve times the number of cubic feet it contains.

Board of Arbitration. Commission formed by the Government, or otherwise organized, to settle disputes between employers and employees.

Board of Examination. Convened to determine on the fitness of officers for promotion in the several corps and line of the army. In the medical corps similar boards are appointed to examine candidates for appointment.

Board of Survey. Officers convened to fix the responsibility for public property lost, damaged, or destroyed, ascertain what articles of public property may have been lost or abstracted whenever a soldier deserts, and to take an inventory of public property in charge of a deceased officer.

Board of Trade. Society of merchants, to promote commerce and further their general and particular interests. Such bodies often have much influence on the economic policy of the Government and may be intrusted with certain public powers.

Boar-Fish. Acanthopterygious fish, *Capros aper,* of the family *Zeïdæ.* Name given to various heterogeneous fishes which have a snout resembling that of the boar.

Boatbill. *Cochlearius.* S. American Heron with a remarkably broad bill that resembles that of *Balæniceps.* It is a smaller bird than the latter, and has much shorter legs. It

Boatbill (*Nycticorax cancrophagus*).

bears a large and lengthened crest on back of head and neck. It has four pairs of powder-down patches, and the skin between the rami of the mandible is dilatable like that in Pelicans.

Boatswain. Ship's officer who has charge of the cordage, rigging, anchors, etc.

Bob. In mining, a piece of mechanism by which a rod moving in one direction transmits motion to a rod moving in a different direction.

Bobbin. In a weaving loom, the spool for the thread.—Also, coil of insulated copper or iron wire wound upon a spool and forming part of some electro-magnetic apparatus; coils that revolve in front of the poles of a magneto-electric machine; separate coils of a ring or drum armature.

Bob-Cherry. English children's game: jumping at cherries above their heads and trying to catch them with their mouths.

Bobolink. One of the *Icteridæ* (*Dolichonyx orizivorus*), resembling a sparrow, but tail feathers acute. Length 7 in. They migrate n. in early summer, and the male, a good singer, changes its colors so as to be black, with buffy neck, streaked back, and the rump, shoulders, etc., ashy white. After the brood is raised, in autumn, they gather in flocks among the reeds, where they become fat, the male moulting its courtship plumage and becoming nearly silent. They are now known as

Reed-birds. When the frosts appear they go s., migrating by night, to fatten in the rice-fields, and are called Rice-birds. When fat, a great delicacy.

Bob White. Nick name for the QUAIL (q.v.) in the n. U. S. In the South it is called Partridge.

Bocage, MANOEL MARIA BARBOSA DU, 1765–1805. Portuguese poet.

Boccaccio, GIOVANNI, 1313–1375. Italian poet and novelist. His masterpiece, the *Decameron*, is a series of stories, written 1344–50, and displaying marvelous narrative skill. It has been called. in contrast with Dante's great poem, the *Commedia Umana*. It satirizes churchly asceticism, and belongs to the "fleshly" school in literature. B. wrote also a life of Dante and a commentary on part of the *Inferno*. In poetry, his most elaborate effort is the *Teseid*, from which Chaucer drew his *Palamon and Arcite*. He wrote also the *Filostrato*, the source of Chaucer's *Troylus and Cressida*. The romances, *Filicopo* and *Fiametta*, are among his minor works. B. is said to represent the lower class in society, while Petrarch represents the middle, and Dante the nobles.

Boccage, MARIE ANNE FIQUET DU, 1710–1802. French poet. *The Columbiad*, 1756.

Boccalini, TRAJANO, 1556–1613. Italian satirical poet.

Boccherini, LUIGI. 1740–1805. Italian composer of chamber music. His model was Haydn.

Bochart, SAMUEL, 1599–1667. French Protestant, pastor at Caen from 1626. *Geographia Sacra*, 1646; *Hierozoicon* (Bible animals), 1663.

Bodenstedt, FRIEDRICH MARTIN VON, 1819–1892. German poet, traveler, and translator of Russian and Persian poems. *Peoples of the Caucasus*, 1848; *From Atlantic to Pacific*, 1882. His *Songs of Mirza Schaffy*, 1851, were wrongly supposed to be translations. He wrote much on Shakespeare.

Bode's Law. Series of terms expressing approximately the distances of the planets from the sun. The number 4 is written down a number of times, to the second 4 is added 3, to the third 6=2x3, to the fourth 12=2x6, and so on; thus we obtain the series, 4, 7, 10, 16, 28, 52, 100, 196, 388. the first terms of which at least represent, with some approach to accuracy, the relative distances of the planets.

Bodleian Library OF OXFORD UNIVERSITY. Founded 1597 by Sir Thomas Bodley (1544–1612), and since enriched by many gifts; now containing over 400,000 volumes and 30,000 MSS.

Bodmer, JOHANN JAKOB, 1688–1783. Swiss journalist, poet and critic; prof. at Zurich; tr. *Paradise Lost*. *Noachide*, 1752.

Bodtcher, LUDVIG ADOLF, 1793–1874. Danish poet.

Body. Definite portion of matter, either solid, liquid or gaseous. A rigid body is a system of particles so related that though the system may move as a whole with reference to other bodies, its separate parts can have no relative displacement; it may have any motion of translation and of rotation, and, therefore, is said to have six degrees of freedom in its motion.

Body-Whorl. Last and largest turn of the gastropod shell.

Boece or **Boyce,** HECTOR, ab. 1465–1536. Scottish scholar; prof. Univ. Paris 1497, Aberdeen ab. 1501; author of a Latin history of Scotland, 1527.

Boeckh, AUGUST, 1785–1867. Prof. Berlin 1810; classical philologist; principal works are, *Pindar*, 1811–25; *Corpus Inscriptionum Græcarum*, 1825, et seq.; *Encyclopædia and Methodology of Philology*, 1877.

Boehme or **Behmen,** JACOB, 1575–1624. German mystic; maker of shoes and gloves at Görlitz. *Aurora*, 1612; *Way to Christ*, 1624. His works were tr. 1644 and later, and profoundly influenced some English thinkers, as Wm. Law and John Byrom.

Boehmischbrod. Scene of Taborite defeat, May 30, 1434, by the Calixtines, who became the dominant party in Bohemia.

Bœotia. Ancient state of Hellas, inhabited by Æolians from Thessaly. Their dullness was ascribed to their damp and ungenial climate. Thebes was the leadingcity. B. rose to great-ness ab. 370 B.C. through Epaminondas and Pelopidas.

Boerhaave, HERMANN, 1668–1738. Eminent physician and chemist. Prof. Leyden 1709; the last distinguished chemist to retain some of the alchemistic ideas. *Historia Plantarum*, 1727–38; *Elementa Chemiæ*, 1732, was the first systematic work on chemistry.

Boers. Dutch settlers in s. Africa. The Transvaal Republic was established 1848, and a Constitution proclaimed Feb. 13,

Boers.

1858. The British took possession April 12, 1877, and suppressed an insurrection 1881. Ab. 60,000 in that province 1890.

Boëtius or **Boethius,** ANICIUS MANLIUS TORQUATUS SEVERINUS, ab. 476–525. "Last of the Romans." Philosopher and statesman, accused of treason and beheaded by Theodoric. His *Consolation of Philosophy* had extraordinary influence in the Middle Ages, and he was mistakenly regarded as a Christian saint and martyr.

Bofarull y Broca, b. 1821. Spanish poet. *History of Catalonia*, 9 vols., 1876–78.

Bogart, JOHN, b. 1836. Designer of parks at Albany and Nashville, State Engineer of N.Y. 1888–92, Sec. Am. Soc. of Civil Engineers 1877–91.

Bogatzky, KARL HEINRICH VON, 1690–1774. German pietist. His *Golden Treasury*, 1718, tr. 1745, has been very popular.

Boggs, FRANK MYERS, b. 1855. American marine painter.

Bogh, ERIK, b. 1822. Danish dramatist, poet, and novelist.

Boghead Coal. Variety of Cannel coal from Torbane Hill, Scotland, and has been distilled for oil, yielding 120 gals. per ton.

Bogie. English term for that feature of the running gear of American railway cars usually called the truck. A frame carrying four or six wheels supports each end of the car, and is connected thereto by a central pin called the truck-pin. The long car body can therefore easily come into the chord of the arc of a sharp curve in the track, while each of the short trucks remains on the true arc. It thus becomes possible to use sharper curves and therefore a less costly alignment for the road than is required where there can be no convergence of the axles at the two ends of a car: or where there is an "inflexible wheel-base" to the car. This construction is applied to the front end of the locomotive engine.

Bog-Iron Ore. Brown hematite, limonite, $2Fe_2O_3.3H_2O$. An uncrystallized hydrous oxide, or mixture of several hydrous oxides, of iron, formed by the action of water in low, marshy spots. When pure, it contains 59.5 per cent iron, usually 15 per cent less. It is used as an iron ore; but yields cold-short iron, due to presence of phosphorus.

Bog-Manganese. $2MnO_2 + aq$. Dark earthy aggregate of several hydrous oxides, sufficiently rich in manganese to pay for working. Found in small quantities along the Appalachians from Me. to Ga.; also called Wad.

Bog-Mosses. See SPHAGNACEÆ.

Bog-Myrtle. *Myrica Gale.* Shrub of the natural family *Myricaceæ*, native of northern hemisphere.

Bogomiles. Sect of e. Europe, named from a Bulgarian priest ab. 950; persecuted for 500 years. Its doctrines were Gnostic or Manichean.

Bogota, or SANTA FE DE BOGOTA. Capital of Colombia, at base of the Andes, 8,720 ft. ab. the sea. Pop. ab. 120,000.

Bogota.

Bog-Rush. Species of the genus *Juncus*, more commonly known as Rushes.

Bogue, DAVID, D.D., 1750–1825. Scottish divine; author, with James Bennett, of *History of Dissenters*, 4 vols., 1808–12.

Boguslawski, GEORGE H. VON, 1827–1884. Editor of the *Annalen der Hydrographie;* author of various articles on temperature and of *Oceanographie.*

Bohaddin, or BOHA-EDDYN, 1145–1235. Arabian scholar and statesman: author of *Laws and Discipline of Sacred War* and *Life of Saladin.*

Bohemia. Country of central Europe, named from the Boii, who settled there in 2d century B.C., finally occupied by a Slavic race, the Czechs, ab. 570; christianized ab. 880 from Moravia; ruled till 1306 by dukes of Prague, with title of King, as a state of German Empire; then by the House of Luxemburg till 1437. THE HUSSITE WARS (q. v.) ended in making the monarchy elective. After the battle of Mohacz, 1526, B. was merged in Austria. Severe persecutions, chiefly 1616–37, suppressed Protestantism and nearly ruined the country. Area, 20,065 sq. m.; pop., 1890, 5,843,094, nearly two-thirds Czech.

Bohemian Brethren. Later Hussites, survivors of the Taborites, organized by Gregor ab. 1457. After long and severe persecution, their scattered remnants were gathered 1722 by Zinzendorf; since known as Moravians.

Bohemian Glass. Very hard, not easily fusible, resisting the action of chemicals; much used in the manufacture of chemical apparatus. It is made from silica, potassium and calcium carbonates.

Böhler, PETER, 1712–1775. Moravian Bishop 1748, laboring in England and America; memorable for his influence on J. and C. Wesley 1738–9.

Böhm von Bawerk, EUGEN, b. 1851. Economist; prof. Innspruck, councilor in the Austrian Finance Department. *Capital and Interest*, 1884–89.

Böhtlingk, OTTO, b. 1815. Russian philologist, tr. of the *Sakuntala*, 1842, the *Upanishads*, 1889, and other Sanskrit works, author of several grammars, and, with R. Roth, of a great Sanskrit-German lexicon, 1852–75, which he abridged in 7 vols., 1879–89.

Boiardo, MATTEO MARIA, Count of Scandiano, ab. 1430–94. Italian poet. His *Orlando Innamorato*, 1486, became more popular in the burlesque versions of F. BERNI (q. v.), 1541, and L. Domenichi, 1545. Ariosto's *Orlando Fusioso* is a continuation of Boiardo's poem.

Boieldien, ADRIEN FRANÇOIS, 1775–1834. Master composer of the French polite comic opera school. *Le Calife de Bagdad*, 1800; *Jean de Paris*, 1812; *La Dame Blanche*, 1825. The last, his masterpiece, introduces Scottish melodies.

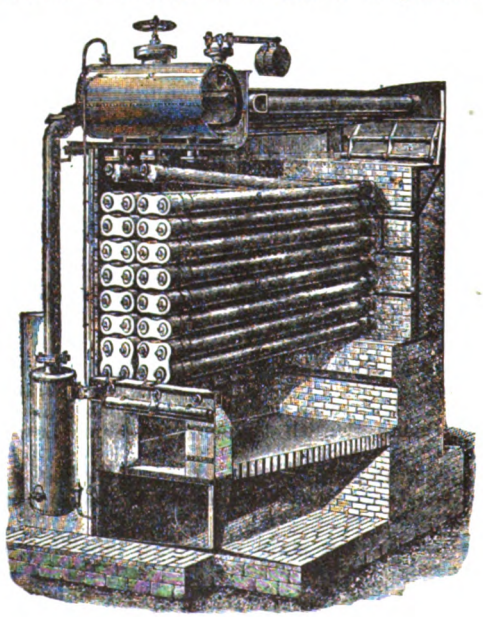
Boil. Furuncle, or painful localized inflammation of the skin and the tissues immediately beneath it; distinguished from a carbuncle by having only one opening, in the center of which is a core or piece of dead flesh; due to local irritation, various diseases, as diabetes or scrofula, or to some not well understood constitutional taint; best treated by poulticing, free opening, and measures to restore the general health.

Boileau-Despréaux, NICOLAS, 1636–1711. French poet and critic. He wrote satires, epistles, epigrams; a noted mock-heroic poem, *Lutrin*, 1674, and *Reflections on Longinus*, 1693. His *Art of Poetry*, 1674, exerted great influence, and he was for some time a sort of literary dictator.

Boiler Corrosion. This is due in the Coal Regions especially to the use of mine waters containing ferric sulphate and free acid. This has been remedied by neutralizing with lime or sodium carbonate. In some localities water containing organic matter from swamps corrodes iron. The suspension of a slab of zinc in the boiler remedies this.

Boiler Deposits. These are formed from substances dissolved or suspended in the water used. They are diminished by frequent blowing off. The most common ingredients are sulphates and carbonates of calcium and magnesium. The former can be removed from the feed-water by precipitation with carbonate of sodium and the latter by heating with the exhaust steam, which also causes precipitation. The following mixture has been used, a small quantity being introduced into the boiler every day, the above-named impurities being thus kept in solution or in suspension, and blown out the waste-pipe. The mixture is ground logwood 8, sal ammoniac 1, chloride of barium 1.

Boiler, STEAM. Vessel for the generation and storage of steam for industrial purposes. Its design aims at economy in generation of steam from the fuel, and at safety in storage of the steam and heated water. The sphere is the form adapted to resist internal pressure, but it is not suitable to most economical transfer of heat, nor is it easy to construct on a large scale. The cylinder is next best for resisting pressure, and is well adapted to absorb heat. The conductivity for heat possessed by copper has made it in the past a favorite material for boiler purposes. It is now limited to non-American practice for locomotive fire-boxes. (See FIRE-BOX and LOCOMOTIVE.) Wrought iron and steel are most used, cast iron being applicable only to a few sectional types. The usual types are as follows: 1st. The plain cylinder boiler, best suited for impure water and long flame or gaseous fuels. It is the usual blast-furnace boiler of this country, and sometimes 60 ft. in length. A modification of this is the French or Elephant or Union



Coil Boiler.

boiler, in which there are two cylinders, one on top of the other, and connected by necks. 2d. The flue boiler, in which 1, 2, 3, 5 or 7 large flues connect the two heads of the boiler, passing through the water. An increase in heating surface results

from this arrangement, and the heat is abstracted from the gases without so great length of boiler. The Cornish boiler has one large flue and the fire and ash-pit are inside it. The Lancashire boiler has two flues. The Galloway boiler has conical water-tubes traversing the fire-tubes to abstract more completely the heat of the gases and increase heating surfaces. Flue boilers are applicable for inferior waters and bituminous fuels. 3d. The tubular or multitubular boiler. The few flues of large diameter in the water space are replaced by a great number of smaller tubes, expanded into the two heads. A large increase of heating surface is secured and rapid steaming capacity. Tubular boilers are applicable for pure waters and anthracite or non-flaming fuels. 4th. The locomotive and upright boilers are modifications of the tubular, in which the fire is internal to the water being evaporated, and is in a fire-box. These require no setting, cause little loss by radiation of heat, and are rapid steamers. The upright boilers are likely to give wet steam, and the upper ends of the tubes are not submerged in water, giving rise to leakage and failure at that place. The fire-engine boiler is an upright, but is often made with the tubes submerged. 5th. Sectional boilers, in which the generation and storage are carried on in a number of separate vessels connected to deliver at one outlet. By this means failure or rupture of one unit does not necessitate the renewal of the boiler as a whole, nor will the failure of one section necessarily involve a disaster, as the overpressure will relieve itself at safe velocity through the small outlet thus afforded. Such boilers are also easily transported. The sections are either spherical or more usually made up of lap-welded wrought-iron tubes, the water being inside. 6th. Water-tube or coil boilers, in which the water circulates inside of the tubes, while the fire is outside. Several of the sectional boilers are of this type. In the coil boilers, however, the coil is a continuous spiral coil, and the water is circulated in it, either naturally or by a pump.

Boiler Tubes. Lap-welded wrought-iron pipe, made with special care for the smaller flues of steam boilers, or for the passage of gases in multitubular boilers. They differ from pipe only in being of thinner gauge for any diameter, and in being known by the outside diameter instead of the diameter of the bore.

Boiling Point. Temperature at which the vapor pressure of a liquid is just equal to the pressure upon its surface. Hence the condition of boiling, as in the case of water, is dependent as much upon the atmospheric pressure as upon the temperature. If the pressure be sufficiently reduced, water may be made to boil at 0° C., or 32° F., and thus in the presence of ice. The boiling point of a chemical compound is determined by immersing a thermometer in its vapor when boiling. The temperature indicated by the thermometer, after being corrected for errors, is the boiling point. Since the boiling point of a pure compound never varies under the same conditions, a determination of its boiling point indicates its state of purity.

Boiling Point of Water. Water boils at the sea-level and under a pressure of the atmosphere represented by 30 in. of mercury at 212° F. For each pound of pressure above the atmosphere on the surface of the water its boiling point rises, at first by ab. 3°.5 diminishing to 2° at 13 lbs., falling to 1° at 52 lbs. and being only ab. 0°.5 at 150 lbs.

The boiling points in F. degrees for various pressures are given in the subjoined table:

Pressure in lbs.	Boiling Point.	Pressure in lbs.	Boiling Point.
Atmos.	212°	120	350°
15	250°	135	358°
30	274°	150	365°
45	292°	165	373°
60	307°	180	379°
75	320°	195	386°
90	331°	250	403°
105	341°	300	420°

Boise, Otis B., b. 1845. American musical composer, living in Berlin.

Boisgobey, Fortune du, b. 1824. French romancer of the school of Gaboriau.

Boissier, Edmond, 1810–1885. Swiss botanist. *Voyage Botanique*, 1839–45; *Flora Orientalis*, 1867.

Boissier, Marie Louis Gaston, b. 1823. Prof. College of France 1861; member Academy 1876; writer on Latin of classics.

Boissonade, Jean Francois, 1774–1857. Noted Hellenist; prof. Coll. of France from 1828. *Sylloge Pœtarum Græcorum*, 24 vols., 1823–26.

Boito, Arrigo, b. 1842. Italian poet and composer. His musical masterpiece is *Mefistofele*, 1868. He wrote the libretti for Verdi's *Otello* and *Falstaff*, and Ponchielli's *Gioconda*, besides many other lyrical dramas.

Bojanus, Organ of. Kidney of the clam-like Molluscs; pair of segmental tubes, each bent once on itself, near the hinge of the shell, forming the floor of the pericardium or body cavity.

Boker, George Henry, 1823–1890. Poet and dramatist; U. S. minister to Turkey 1871–75, and to Russia 1875–79. *Calaynos*, 1848; *Anne Boleyn*, 1850; *Francesca da Rimini*, 1853; *Poems of the War*, 1864; *Book of the Dead*, 1882.

Bokhara. Khanate of central Asia, in Turkestan; area ab. 92,000 sq. m. The e. part is mountainous, with spurs from the Hindoo Koosh and Thian Shan ranges; the w. part is a desert. The habitable land lies along its few streams. Pop. ab. 2,500,000. Its capital, Bokhara, is noted for mosques and schools, and has an important commerce. Pop. ab. 100,000.

Bol, Ferdinand, 1611–1680. Dutch painter.

Boldrewood, Rolf. See Brown, Thomas A.

Bolero. Spanish dance of lively movement and castanet rhythm, *i.e.*, ♩♫ ♩♩♩♩

Boleslas, I., d. 1025. First king of Poland. Otho III. gave him royal title, and freed Poland from dependence on the Empire 1001. He made Moravia tributary.

Boletaceæ. Family of Fungi of the order *Hymenomycetes*, including many of the Toadstools.

Boletus edulis.

Boleyn or **Bullen,** Anne, 1507–1536. Second queen of Henry VIII. 1533; mother of Queen Elizabeth; accused of infidelity, and beheaded May 19, 1536.

Bolingbroke, Henry St. John, Viscount, 1678–1751. English statesman; Sec. of War 1704–8, Foreign Sec. 1710; Premier 1714; attainted 1715, and in France till 1724; a brilliant but discursive writer, to whom Pope dedicated his *Essay on Man*. *Works*, 5 vols., 1754.

Bolintineanu, Dimitrie, 1826–1872. Roumanian poet and journalist, exiled 1849. He wrote also in French.

Bolivar, Simon, 1783–1830. Leader in freeing from Spanish control successively (1813–22) Venezuela, New Granada, and s. Peru, which last in honor of him was named Bolivia. After acquiring their independence, he was intrusted with the administration of their affairs.

Bolivia. Republic of w. S. America; area ab. 515,16 1sq. m. The w. part is occupied by the Andes, which here attain a great elevation, having many peaks exceeding 20,000 ft. The e. part is low and level, and is drained by the upper waters of the Amazon and the Paraguay. The climate of the low country is tropical; that of the habitable portions of the mountain region temperate. Pop. ab. 1,434,800. Its productions are chiefly cotton and sugar, lumber and india-rubber. Its mineral resources are very great, including the once celebrated silver mines of Potosi, besides gold and copper. The government is republican in form. The capital is Sucre. The chief city is La Paz, pop. ab. 65,000. Under Spanish rule B. was a part of Peru; it attained independence 1825, was connected with Peru 1836–39, and lost its sea-coast 1879 as a result of war with Chili.

Bolland, John, 1596–1665. Belgian Jesuit, author or compiler, with G. Henschen, of vols. 1–5, 1643–58, of Acta Sanctorum (q.v.). Those who continued the work are called Bollandists.

Boller, Alfred Pancoast, b. 1840. Civil engineer; designer and builder of the largest drawbridges in the U. S.; author of *Iron Highway Bridges*, 1876; *Thames River Bridge*, 1890.

Bolles, Albert S., Ph.D., b. 1845. Probate Judge 1865–68; Chief Pa. Bureau Statistics 1887; Lecturer on Banking, Univ. Pa. and Drexel Institute, Phila. *Financial History U. S.*, 3 vols.; *Industrial History U. S.; Practical Banking.*

Bolles, Frank, 1856–1894. Naturalist; sec. Harvard Coll. *Land of Lingering Snow*, 1892; *From Blomidon to Smokey*, 1894.

Bollman Truss. Bridge truss, invented by Wendel Bollman 1852, having the characteristic that from each panel point of the lower chord tie rods run to posts at the ends of the span. It was never employed for spans longer than 200 feet, and has now gone out of use.

Bologna. City of n. Italy, at the foot of the Appenines, between the rivers Reno and Savana. An ancient Etruscan city (Felsina), it became a Roman colony (Bononia), 189 B.C., a free city under Charlemagne, and part of the papal dominions 1513. Pop. ab. 120,000. The Picture Gallery has few works of importance aside from Raphael's *St. Cecilia*. The prehistoric Museum (*Museo Civico*) is of great importance. The Cathedral of San Domenico (12th cent.) contains the tomb of the Saint, with

Market-Place, Bologna.

statues of angels by Nicolo of Pisa and Michelangelo. Two leaning towers (12th cent.) are respectively 320 and 163 ft. high.

Bologna, SCHOOL OF. This includes the leading Italian painters of the 17th century, when the SCHOOL OF NAPLES (q.v.) was its rival. Its artists are known as the Eclectics or Imitators, both titles showing their professed dependence on their predecessors. The leading names are Guido Reni, Domenichino (Zampieri) and Guercino (Francesco Barbieri). The academic teachers and heads of this school were the three Caracci (Annibale, Agostino and Ludovico).

Bologna, UNIVERSITY OF. Lectures on the Civil Law were begun here by Irnerius ab. 1113. From that time till ab. 1300 it was recognized as the chief school of both Civil and Canon Law. Barbarossa granted special privileges 1158. Ab. 1260 there are said to have been 10,000 students, mostly foreigners. Medicine and the arts began to be taught ab. 1200. In 1371 there were 30 salaried professors, besides those of Theology. The first college was founded 1256; another 1326; and a Spanish college 1364, the last still in existence. The univ. had a faculty of 90, ab. 1,400 students, and a library of 160,000 vols.

Bologna, GIOVANNI DA, 1524–1608. Flemish sculptor, active in Italy. His best known works are: the Fountain in Bologna, *Rape of the Sabines* and *Mercury*, in Florence.

Bolometer. Apparatus devised by S. P. Langley, and sometimes called "Langley's thermic balance." It is used as a very delicate measurer of heat. Its action is dependent on the principle that the electrical conductivity of a metal is diminished as it rises in temperature. If a delicate differential galvanometer be acted on by two equal and opposite currents, its needle will remain unaffected; if in one of the circuits is a thin strip of iron or platinum a slight change in the temperature of this will change its conductivity and this will immediately be indicated by a deflection of the galvanometer needle. The balance has been used by Langley for studying the distribution of energy in the ultra-red spectrum, and it is said to be sensitive to differences of temperature of 0.0001° C.

Bolster. Timber placed under end of a bridge truss and projecting outward under the chord for a short distance; or between the cap of a trestle and the stringer which it supports.

Bolton. Cotton manufacturing city of Lancashire, 12 m. n. of Manchester. Pop., 1891, 115,002.

Bolt-Rope. Rope which goes round a sail and to which the canvas is sewed.

Bolts and Nuts. The following are the U. S. Standard dimensions in inches for a few common sizes of bolts and nuts, and the safe tensile strain that may be put on the bolt:

Bolts.				Heads and Nuts.				Safe strain in Pounds.
				Across Corners		Thickness.		
Diam.	Threads per Inch.	Diam. at bottom of thread.	Across Flats.	Hexagonal.	Square	Head.	Nut	
$\frac{1}{4}$	20	0.185	$\frac{7}{16}$	$\frac{9}{16}$	$\frac{23}{32}$	$\frac{1}{4}$	$\frac{1}{4}$	270
$\frac{1}{2}$	13	0.400	$\frac{15}{16}$	1	$1\frac{1}{4}$	$\frac{7}{16}$	$\frac{1}{2}$	1,250
1	8	0.837	$1\frac{5}{8}$	$1\frac{7}{8}$	$2\frac{3}{8}$	$\frac{13}{16}$	1	5,500
$1\frac{1}{2}$	6	1.284	$2\frac{3}{8}$	$2\frac{3}{4}$	$3\frac{11}{32}$	$1\frac{3}{16}$	$1\frac{1}{2}$	13,000
2	$4\frac{1}{2}$	1.712	$3\frac{1}{8}$	$3\frac{19}{32}$	$4\frac{13}{32}$	$1\frac{9}{16}$	2	23,000
$2\frac{1}{2}$	4	2.176	$3\frac{7}{8}$	$4\frac{15}{32}$	$5\frac{15}{32}$	$1\frac{15}{16}$	$2\frac{1}{2}$	36,300
3	$3\frac{1}{2}$	2.629	$4\frac{5}{8}$	$5\frac{11}{32}$	$6\frac{17}{32}$	$2\frac{5}{16}$	3	54,200

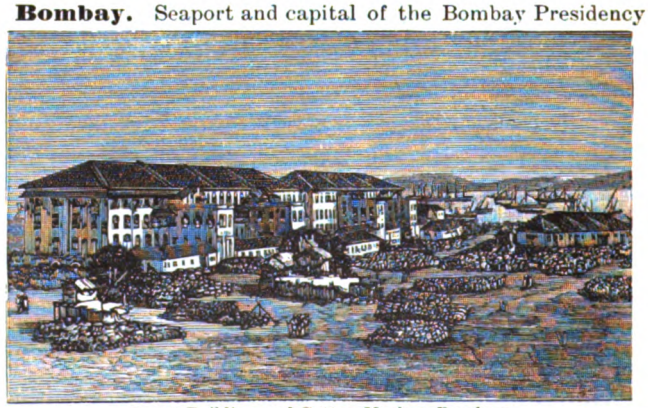
Bolya, WOLFGANG BOLYAI DE, 1775–1856. Hungarian dramatist and mathematician. Prof. at Maros-Vasarhely. He pub. many mathematical memoirs.

Bomarsund. Russian fortress in the Baltic, taken by the British and French Aug. 15, 1854, and destroyed.

Bomb, or BOMBSHELL. Hollow iron projectile containing a bursting charge to be ignited by a time fuse. It is intended to be fired from a mortar or howitzer at a high angle of projection, so that it will descend with such velocity as to be able to penetrate gun and magazine covers, and, on bursting after penetration, to demolish them.

Bombardment. Severe and continuous artillery fire of shot and shell upon a fortified place for the purpose of destroying its means of defense, demoralizing its garrison and inciting such terror among its peaceable inhabitants as to compel the commander to surrender the place. In that period of military history where bombardments were most frequent (1682 to 1815), they were usually the final resort in siege operations when the further progress of the latter was too hazardous for success. The most prominent bombardments recorded in history are that of Algiers by Duquesne in 1682–83, by the Venetians in 1784, and by the English in 1816; of Genoa in 1684; of Tripoli in 1685, 1728, and 1747; of Barcelona in 1691; of Brussels in 1694; of Toulon by the English in 1707; of Prague in 1744, 1759 and 1848; of Lille by the Austrians in 1792; of Le Quesnoy, Breda, Lille, Lyons, Maestrict and Mayence in 1793; of Menin, Valenciennes, and Ostend in 1794; of Copenhagen in 1807, where the English threw over 11,000 shot and shell in three days; of Glogan, Breslau, and Schweidnitz by the French in 1806–7; of Saragossa by the French in 1808; of Flushing by the English in 1809; of Antwerp in 1832; of Saint Jean d'Ulloa by the French in 1838; of Beyrout and St. Jean d'Aca by the English in 1840; of Barcelona by Espartero in 1842; of Mogador by the French in 1844; of Odessa by the English and French fleets in 1854; of Vera Cruz by General Scott in 1847. During the Rebellion Forts St. Philip and Jackson on the Mississippi were bombarded for six days in 1862, and then surrendered; Fort Sumter in Charleston Harbor first in August 1863, and afterward in October; but though the fort was destroyed as a channel defense, it was never surrendered. Over 4,700 shell were fired into Charleston from Cummings Point, a distance of nearly 5 miles, without accomplishing any useful military result. During the Franco-Prussian war Strasburg was bombarded by the Prussians August 18, 1870, and after a great number of shells were thrown into it with ruinous effect, the city was surrendered on September 27. Great destruction of life and property occurred during the siege and bombardment of Paris in January 1871, where over 500 shells were daily, for two weeks, thrown into the city.

Bombay. Seaport and capital of the Bombay Presidency



Grant Building and Cotton Market, Bombay.

of British India, and next to Calcutta the chief commercial

city of India, on the w. side of the Indian peninsula, on a point of high land projecting into the Arabian Gulf from the w. Ghauts. Pop., 1891, 804,470, of whom over half are Hindoos.

Bombay, ISLAND OF. Given to Charles II. of England as the dower of the Infanta Catherina; granted to East India Co. 1668.

Bombay Presidency. W. province of Hindostan, area 125,144 sq. m.; pop. 18,901,123, including Sind and Aden. Comprises 25 British districts and 19 tributary states. Soil fertile, country well watered; products, cotton, rice, sugar and indigo. Revenue (1892), $6,335,253; expenditure, $4,206,813. Railroads open, 3,500 m. Cap. Bombay.

Bombelli, RAFAELLO, 16th century. Italian mathematician. *Algebra*, 1572.

Bombinator. See OXYDACTYLIA.

Bombycina. Tribe of *Lepidoptera*, including moths which fly at night; they have clumsy, hairy, or woolly bodies. The males are often bright colored and more agile than the females, which sometimes have rudimentary wings. Wings are tectiform, at rest. Some species are parthenogenetic. The caterpillars have 16 legs, and are hairy. They spin cocoons and become pupæ above ground. They are harmful to trees. The Silk-worm (*Bombyx mori*) lives on the Mulberry, and is bred for the fibers of the cocoon. A fungus (*Botrytis Bassiana*) attacks the larvæ, producing the disease muscardine.

Bona-Fide Purchaser. One who buys from the holder of the legal title for a valuable consideration, without notice of defect in his title; against him, as a rule, equity will not grant relief.

Bonanza. Spanish word for fair weather, or prosperity; in common use on the Pacific coast, to describe rich portions of mineral deposits.

Bonaparte, CARLO. Corsican lawyer, father of Napoleon I.—His wife, MARIA LETIZIA RAMOLINO, 1750–1836, m. 1767, called Mme. Mère 1804, was of peasant birth and strong character.

Bonaparte, JEROME, 1784–1860. Youngest brother of Napoleon. His marriage to Elizabeth Patterson of Baltimore 1803, was annuled 1805 by the Emperor, who made him King of Westphalia 1807–13. After long exile, chiefly in Italy, he returned to France 1847, and was made marshal 1850.—His son by his first wife, JEROME NAPOLEON, 1805–1870, b. in England, lived and died in Baltimore, and was noted for his likeness to the Emperor.—His son and namesake, 1830–1893, was in the U. S. Army 1852–54, and then in that of France, serving in the Crimea, Algeria and Italy; in 1871 he returned to America.—His brother, CHARLES JOSEPH, b. 1851, is a Baltimore lawyer.

Bonaparte, JOSEPH, 1768–1844. Elder brother of Napoleon; king of Naples 1806–8, and of Spain 1808–13. He lived in the U. S., chiefly at Bordentown, N. J., 1815–32, and 1837–39.

Bonaparte, LOUIS, 1778–1846. Brother of Napoleon I.; king of Holland 1808–10; supposed father of Napoleon III.

Bonaparte, LOUIS NAPOLEON. See NAPOLEON III.

Bonaparte, LUCIEN, 1775–1840. Prince of Canino, ablest of Napoleon's brothers, prominent in affairs from 1798. He declined a throne rather than divorce his second wife, lived in Italy, and wrote two poor epics.—Of his sons, CHARLES LUCIEN, 1803–1857, m. a daughter of his uncle Joseph, lived in the U. S. 1822–28, and pub. *American Ornithology*, 4 vols., 1825–33, a continuation of Wilson's.—LOUIS LUCIEN, 1813–1891, Senator 1852, was a chemist and philologist; and PIERRE NAPOLEON, 1815–1881, was tried 1871 for the murder of Victor Noir.—A son of Charles Lucien, LUCIEN LOUIS, b. 1828, became a cardinal 1868.

Bonaparte, MARIE ANNE ELISE, 1777–1820. Sister of Napoleon I.; princess of Lucca and Piombino 1805; grand-duchess of Tuscany 1809–14.

Bonaparte, MARIE ANNONCIADE CAROLINE, 1782–1839. Sister of Napoleon I.; wife of Murat 1800; Grand-duchess of Berg and Cleves 1806; Queen of Naples 1808.

Bonaparte, NAPOLEON. See NAPOLEON I.

Bonaparte, NAPOLEON JOSEPH CHARLES PAUL, 1822–1891. Son of Jerome, king of Westphalia; member of the French Assembly 1848; received title of prince 1852; married Clotilda, daughter of Victor Emmanuel, 1859; banished 1873 and 1886.

Bonaparte, PAULINE, 1780–1825. Sister of Napoleon I.; m. Gen. Leclerc 1801, and Prince Camille Borghese 1803.

Bonar, HORATIUS, D.D., 1808–1889. Scottish hymnist; Free Ch. minister at Kelso and Edinburgh. His lyrics, many of which are in general use, appeared from 1843, but chiefly in his *Hymns of Faith and Hope*, 3 vols., 1857–64–71.

Bonaventura, ST. (GIOVANNI FIDENZA), 1221–1274. Franciscan monk, general of the order 1256; cardinal and bp. of Alba 1273; canonized 1482. *Doctor Seraphicus.* His *Life of St. Francis of Assisi* and other works have been tr.

Bond. Written instrument, sealed and delivered, binding the obliger to pay a sum of money, absolutely or upon some condition; the seal was conclusive evidence of a consideration at common law, but by modern statutes it is only presumptive; ordinarily it is not negotiable, but commercial usage has given to government and municipal bonds negotiability.—Manner in which the vertical joints of the courses of stone in a wall are laid with respect to each other. In Flemish bond headers and stretchers alternate in each course; in English bond all the face stones appear as stretchers.

Bond, WILLIAM CRANCH, 1789–1859. First director, 1839, of Harvard Coll. Observatory, where he discovered the 7th satellite of Saturn-Hyperion, and the inner, or gauze ring.—His son, GEORGE PHILLIPS, 1825–1865, succeeded him.

Bondone. See GIOTTO.

Bond-Paper. Thin parchment-like paper used by draftsmen; it can be folded without breaking like ordinary drawing paper. It is made from linen rags.

Bonduc. *Cæsalpinia Bonduc.* Vine of the Pea family, producing large and extremely hard seeds. Bonducella (*C. Bonducella*) is a similar plant. Both are widely distributed throughout tropical regions.

Bone. (1) Slaty streaks in coal. (2) The "dry bone" of zinc miners is a cellular, cavernous, zinc carbonate or zinc silicate.

Bone Ash. White powder obtained by burning bones in an open furnace. It usually consists of ab. 80 per cent of calcium phosphate, and 20 per cent of calcium carbonate, magnesium, sodium phosphates, and sodium chloride. It is used in making cupels and hearths for cupeling silver, in white glass and in iron-stone china.

Bone Beds. Thin strata occurring on different horizons, in great part made up of the comminuted bones and teeth of fishes. Thus the Ludlow Bone Bed in the Silurian of England contains the earliest fish remains known in Europe; the Corniferous, in Ohio, often contains little besides the remains of fishes.

Bone Black. ANIMAL CHARCOAL (q.v.).

Bone Caves. See CAVE DWELLERS.

Bone Gelatine, or BONE GLUE. Obtained by boiling bones, cartilage, connective tissue, etc., with water, evaporating the solution in a vacuum pan to a jelly, and drying.

Bonellia. See CHÆTIFERA.

Bone Meal. Bones of animals, ground; fertilizer furnishing phosphate of lime and nitrogen in considerable quantities. The former is only slowly soluble, and for this reason, in order that the plant may use it, the bone should be ground so fine that a large proportion of the particles will pass a mesh $\frac{1}{50}$ inch in diameter. Bone meal makes an especially fine dressing for grasses in permanent pastures and meadows.

Bone Oil, or DIPPEL'S OIL. Tarry product of a disagreeable odor obtained by distilling bones. Bones are boiled in a quantity of water to remove the fatty matter, dried, distilled dry in iron retorts, when bone oil and impurities distill over and condense, and animal charcoal remains behind. This distillate is redistilled, ammonia compounds coming off. First prepared by J. C. Dippel 1711. Pyrrol, pyridine, quinoline, nitriline and their homologues have been separated from it.

Bones. Hard tissues which form the framework or skeleton of nearly all the vertebrates, and consist of ab. 33 per cent of gelatin and other organic matter, 57 of phosphate of lime, and 10 of other salts of lime and magnesium, all of the inorganic matter being uniformly distributed throughout the gelatin, so that when the former are dissolved out the latter retains the natural form of the bone. On their extérior is a tough membrane, periosteum, which supplies them with nourishment; within they are divided up into a number of cavities containing marrow. In many of them, especially those of considerable length, there is a large central cavity, also containing marrow. A familiar illustration of this form of bone is the shinbone of an ox. The bones in the human body, excluding the teeth, number 208.

Boneset. *Eupatorium perfoliatum.* Officinal plant of the natural family *Compositæ*, native of e. N. America.

Bone Turquoise. Fossil bones or teeth, colored by iron phosphate; also called odontolite. It has not the value of the true or oriental turquoise.

Bonghi, RUGGIERO, b. 1826. Italian statesman and author; prof. at Milan, Turin, Florence and Rome; Min. Education 1874–76. *Leo XIII. and Italy*, 1878; *Francis of Assisi*, 1884; *Life of Jesus*, 1890.

Bonheur, MARIE ROSA, b. 1822. French animal-painter. Her leading work, the *Horse Fair*, is in N.Y. Metropolitan Museum.—Her brother, FRANCOIS AUGUSTE, 1824–1884, won repute in the same branch of art.

Bonhomme Richard and SERAPIS, battle of, Sept. 23, 1779. John Paul Jones with three ships encountered two English frigates convoying merchant ships, in sight of the British coast. Jones lashed the *Serapis* to his own ship; both were several times on fire. After a night combat of two hours the *Serapis* surrendered. The *Richard* sank the next morning. The consort of the *Serapis* was also taken.

Boniface, ST., or WINFRID, 680–755. Apostle of Germany, b. in England, missionary 716, Bp. 723, Abp. of Germany 731; killed by pagan Frisians.

Boniface. Name of nine popes. I., 418–422; II., 530–532; III., 607; IV., 608–615; V., 619–625; VI., 896; VII., 974–5, and 984–5, driven from Rome in the interval and credited with the murders of his predecessor and John XIV.; VIII., Benedetto Gaetani, b. 1228, cardinal 1281, pope 1295–1303. He issued the bull *Unam Sanctam*, claiming authority over kings, had much trouble with Philip of France, and died from the rough usage of his foes. IX., Pietro Tomacelli, 1390–1404.

Bonifazio, VENEZIANO, 1555–1579. Venetian painter.

Bonifazio, VERONESE, 1490–1533. Venetian painter.

Bonington, RICHARD PARKES, 1801–1828. English painter, significant with Constable for influence on the modern French landscape school of 1830. He painted landscapes, marines, and figures. His *Column of St. Mark in Venice* is an important possession of the National Gallery in London.

Bonn. City of Prussia, on left bank of the Rhine. Pop., 1890, 39,805.

Bonn, UNIVERSITY OF. Founded 1784; abolished by Napoleon; re-established 1818. It had in 1891 124 instructors; 268 students in theology, 271 in jurisprudence, 281 in medicine, and 399 in philosophy. It has both R.C. and Protestant faculties in theology.

Bonnat, LEON JOSEPH FLORENTIN, b.1833. French portrait painter.

Bonnemaisoniaceæ. Order of red Algæ.

Bonner, EDMUND, ab.1500–1569. Bp. of London 1540; prominent in the persecutions under Mary, deposed and imprisoned 1558.

Bonnet, CHARLES, LL.D., 1720–1793. Swiss naturalist. He studied principally Insects and the leaves of plants, until failing eyesight allowed only of speculative work. He opposed the theory of epigenesis, believing that all the germs of living beings were once for all created in a continuous scale, so that all animate nature is, as it were, one organism, and all parts advance together toward perfection. All living forms are immortal, and live on successively higher planes, so that at death only a coarser body is dropped off to allow the germ of a more refined one to develop. He discovered parthenogenesis in Aphids.

Bonnet of a Sail. Additional piece of canvas, put to the sail in moderate weather to hold more wind.

Bonnivard, FRANCOIS DE, 1496–1570. Prior of St. Victor near Geneva. His imprisonment by the Duke of Savoy in the Castle of Chillon 1530–36, was improved by Byron in a famous poem. He wrote a *Chronicle of Geneva*, 1546–52, and founded its library.

Bonnycastle, JOHN, ab. 1750–1821. English mathematician; prof. at Woolwich 1782–85. His *Mensuration*, 1782; *Geometry*, 1789; *Trigonometry*, 1806; and *Algebra*, 1813, were long held as standard works.—His son CHARLES, 1792–1840, was prof. Univ. Va. from 1825.

Book. The Assyrians preserved their literature upon clay tablets or upon the papyrus leaves, the Egyptians used the latter, and parchment was employed by the Persians. Paper is said to have been invented in the first century. The earliest books were historical records or associated with the religious rites or beliefs of the Ancients. The oldest papyrus dates 2000 B.C. These materials have been used by the various peoples of the world, the cheapening of their production and the invention of printing and machinery having reduced the cost of books to the minimum at the present time.

Book-Binding. In 6th century the Byzantines bound religious works in enameled ivory. From this time to the invention of printing, beautiful illustrated MSS. for kings and princes were bound in carved and enameled wood, ivory, silver and gold, sometimes even set with gems. Princes and prelates bestowed such jeweled treasures upon their favorite abbeys and churches, which gifts were placed upon the high altar. The productions of monkish scribes were protected with simple parchment, or with leather-covered boards, bossed, tipped, and clasped with metal. Elaborately decorated silk, velvet, leather and vellum next came into fashion, Italy setting the example of employing artists on the designs. Grolier, treasurer to Francis I., brought the taste from Milan, and for the next two centuries Paris was the paradise of bibliophiles. Grolier's bindings are still a standard of beauty and excellence. England did not come to the front till the 18th century, when Roger

Byzantine Binding, 8th Century.

Payne, d. 1797, did the best work. The most celebrated binders of the present century are Faraday, Mackenzie, Hayday, Rivière, Bedford, Tuckett, Ramage, and Zaehnsdorf.

Book-Club. (1) Association for printing books upon some special subject, which are given to the members, who pay an annual fee. The earliest was the Dilettanti Society 1734, which printed *Antiquities of Ionia*, 4 pts., 1769–1882. There are many in Great Britain in various branches of literature, history and science. In U. S. some of the societies publish books. The Grolier Club of New York is strictly a book-club. Societies which publish transactions and proceedings are not properly classed under this head. (2) Book-clubs also exist in U. S. for purchasing new books for circulation among the members, the books being finally sold to members by auction or otherwise.

Bookkeeping. Record of pecuniary transactions in systematic manner. The principal methods are by single and double entry. The former is more simple and less perfect than the latter, and is usually confined to the less important kinds of business. In single entry three books are used, day-book, cash-book and ledger. The most important book is the ledger, which contains accounts under the names of the persons with whom a trader deals. Goods or moneys received from any one are entered on one side of the account, and goods sold or money paid to that person on the opposite side. In double entry the ledger accounts are of two kinds, personal accounts, like those described, and book accounts, in which the commodities are made the subjects of separate accounts, which have a debit and credit side like personal accounts. Thus, if a trader purchases 100 bushels of wheat from A, the account of the ledger headed A is credited with 100 bushels of wheat, while the account headed wheat is debited with the same quantity and amount. Should the trader sell 10 bushels to C, the account headed C is debited with 10 bushels at a certain price and the account headed wheat credited. In this way every transaction is entered in the ledger, on the credit side of one account and on the debtor side of another. Double entry books vary in number and arrangement with the nature of the business in which they are used. Daily transactions are generally recorded in various books, as the stock-book, cash-book, bill-book, invoice-book and sales-book. On these are based the journal and ledger. The former contains a periodical abstract of all transactions recorded in the subordinate books, classified into debits and credits, and the latter an abstract of all the entries made in the former, classified under the heads of their respective accounts.

Book of Changes. Yik King, or "Divination Classic" of the Chinese, to which they ascribe a high antiquity, based on 64 diagrams (*kwá*), formed by combination of broken and unbroken lines, taken six at a time. These are accompanied by explanatory text and appendices, the latter of which are attributed in part to Confucius.

Book of the Dead. Ancient Egyptians, after embalming, entombed their dead, reciting prayers referring to the future life, believing that thereby they insured the deceased speedy access to God, victory over ghostly foes on the way, power for the body to resist corruption in the tomb and new life in a glorified body in heaven. This liturgy must date from a very remote antiquity, since isolated chapters are

found on tombs and pyramids of the second dynasty. One text on a coffin dates from ab. 4266 B.C. The Book of the Dead consists of these funerary texts, established as the authorized version by the priests of Annu ab. 3500–3100 B.C. Versions of the ritual were buried with the mummy. The Theban Version (18th to 20th dynasties), was written on papyri 18 to 20 ft. long, 14 to 18 in. wide, with colored vignettes of scenes beyond the grave. Though the text selected was left to individual choice, yet certain chapters were absolutely necessary for the body's preservation in the tomb and the soul's welfare in its new conditions. We owe most of our knowledge of Egyptian beliefs to these Books of the Dead.

Book Plates. Labels to be placed inside the covers of books originated in the 15th century. These plates had some armorial or allegorical design, beneath which was the owner's name. They were much used in England, but the custom is not followed to any extent of late years.

Bookworm. Larva of *Anorbium pertinax*, about half an inch long, with a soft body and a brown horny head. It bores through the cover and into the leaves. They are uncommon in U. S. A small white slick perforates papers and cockroaches eat bindings.

Boole, GEORGE, 1815–1864. English mathematician and logician; prof. at Cork. *Mathematical Analysis of Logic*, 1847; *Laws of Thought*, 1854; *Differential Equation*, 1859; *Calculus of Finite Differences*, 1860.

Boomerang. Weapon used in Australia by the aborigines. It consists of a thin, flat piece of wood, a little flatter on one side than on the other, nearly two inches wide, and pointed at both ends, cut from a branch which has a bend of 100° to 130°. It is ab. 16 in. long, and the

Various Forms of Boomerang.

bend comes in the same plane as the edges. When this is thrown against the wind so as to turn round and round, it comes back to the thrower, but if it strikes an object its force is spent. It is used to kill birds and small mammals. It can be thrown 300 ft., and as a weapon in war it is effective.

Boone, DANIEL, 1735–1820. Early settler of Kentucky, hunter and Indian fighter. He moved to Missouri 1795.

Boos, MARTIN, 1762–1825. German R. C.; mystic, subjected to much persecution. *Autobiography*, 1831, tr. 1836.

Booted. Tarsus of a bird when inclosed by a single plate, as in the robin.

Booth, ABRAHAM, 1734–1806. Baptist pastor in London 1769. *Pœdobaptism Examined*, 1784.

Booth, BARTON, 1681–1733. English actor, eminent in Shakespearian parts.

Booth, EDWIN, 1833–1893. American actor of highest rank and character; second son of Junius B. Great in many parts, he is most famous as Hamlet and Richelieu. He built Booth's Theater, N. Y., 1868–9, and managed it till 1874. In 1891 he retired.

Booth, JUNIUS BRUTUS, 1796–1852. Anglo-American actor, whose genius and infirmities were equally notable. After winning fame in England, he removed to the U. S. in 1821, and became well known from Boston to New Orleans.—His youngest son, JOHN WILKES, 1838–1865, was the murderer of Pres. Lincoln 1865.

Booth, MARY LOUISE, 1831–1889. American author, tr. of many French books, editor of *Harper's Bazar* from its start in 1867. *History of N. Y. City*, 1859–67.

Booth, WILLIAM, b. 1829. General of the Salvation Army 1878; minister Meth. New Connection 1850–61. In 1865 he began a mission in the East End of London, out of which the Army grew. Pub. the *War Cry* from 1880, and many hymn-books, tracts, etc.

Boothia. Island of N. America in Arctic Ocean.

Booty. Movables captured on land by the enemy in war; claimed by the captors' State, which generally gives a part or all to the captors. The modern tendency is to limit booty to public property and to contraband of war.

Bopp, FRANZ, 1791–1867. Prof. Berlin 1821; originator of the science of Comparative Philology. His *Comparative Grammar*, 1833–52, opened a new field of research. He also edited Sanskrit texts.

Bora. Strong north wind blowing over s. Russia, Turkey, and Austria; when it reaches the Italian and French coasts of the Mediterranean it becomes the Mistral. When blowing from the highlands of Dalmatia and Istria down upon the Adriatic, it is called the Fall wind. It is similar in most respects to the dry Northers of the U. S.

Bora, KATHARINA VON, 1499–1552. German nun, who left her convent 1523, and married Martin Luther 1525.

Boracite. $2Mg_3B_8O_{15}+MgCl_2$. Magnesium borate and chloride, associated with anhydrite, gypsum, and rock salt. Its crystals often show combinations of a cube and tetrahedron.

Borage. *Borago officinalis.* Blue-flowered plant of the natural family *Boraginaceæ*, native of Europe, formerly used in medicine.

Boraginaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising 77 genera and ab. 1,235 species, widely distributed throughout all parts of the earth. Also known as *Asperifoliæ*. Commonly called the Borage family.

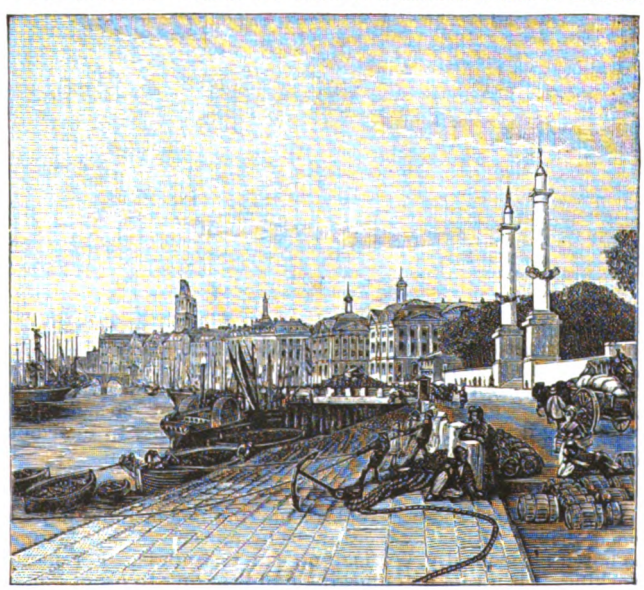
Borates. Salts of BORIC ACID, H_3BO_3 (q.v.).

Borax. $Na_2B_4O_7+10H_2O$. Sodium biborate, containing 47 per cent water. It occurs as a mineral in and about saline lakes and marshes in many parts of the world. S. Cal. and Nevada contain large deposits. Crude borax from India was formerly known as tincal. Native boracic acid, such as is found in lagoons in Tuscany, and a native borate of lime and sodium, supply raw material for the manufacture of borax. It is mildly antiseptic, but is rarely used as such, being chiefly employed in the treatment of sore mouth, more particularly in nursing infants. It is used in the chemical arts and in metallurgy. In 1892 6,000 tons were produced in U. S.

Bord and Pillar. System of coal mining, in which the coal is obtained from rectangular rooms (bords), separated by portions of coal left standing as supports. The relative widths vary in different localities, and according to the strength of the coal. A somewhat similar system is known as post and stall.

Borda's Pendulum. Besides the use of the pendulum for regulating time-pieces, it is widely employed in science for measuring the intensity of gravity on the earth's surface. J. C. de Borda (1733–1799) determined this constant, g, at Paris, by means of this pendulum. His idea was to approximate as closely as possible to an ideally simple pendulum. For this purpose he suspended a platinum sphere by a fine platinum wire, the latter being attached to a small concave cap accurately fitting the sphere; contact between the two was maintained by the pressure of the air.

Bordeaux. One of the chief commercial cities of France,



Bordeaux.

on left bank of the Garonne, 60 m. from its mouth. Its trade

is largely in wine, and shipbuilding is an important industry. Pop., 1891, 252,415.

Bordeaux. Variety of artificial red dye-stuffs, mainly azo derivatives of naphthalene and benzene.

Bordered Pits. Large circular markings on cell walls of many plants, especially of *Coniferæ;* thin places, lenticular in shape, with a middle plate. Known also as discoid markings.

Bordone, PARIS, 1500–1570. Venetian painter, ranking with Palma Vecchio and subordinate only to Titian and Giorgione, who were his masters. His paintings are not numerous, and are chiefly fine portraits in Venice Academy.

Boreas. Impersonation of the N. or N.NE. wind, dwelling in a cave in Mt. Hæmus.

Borecole. Variety of cabbage.

Borel, PETRUS, 1809–1859. French poet and novelist.

Borghese, CAMILLO FILIPPO LUDOVICO, PRINCE, 1775–1832. Owner of one of the finest palaces in Rome, and of a collection of antiquities and art treasures which he sold for 13,000,000 francs to Napoleon, whose sister Pauline he had married 1803; duke of Guastalla 1806.

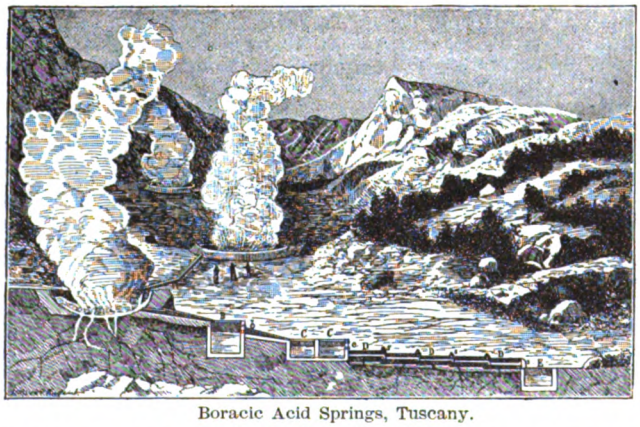
Borghese Gallery. Moved to the Borghese Palace, Rome, 1891, contains the finest collection of pictures in that city, after that of the Vatican. There are ab. 600 pictures. Among these are the *Entombment*, by Raphael; *Danæ*, by Correggio; *Celestial and Earthly Love*, by Titian; *Diana and Nymphs*, by Domenichino.

Borghese Villa. On the outskirts of Rome, near the Porta del Popolo. It contains a fine collection of antiques, including the magnificent statues of *Anacreon* and *Alcœus*, and a *Faun*, superior in chisel execution to any other ancient Faun statue.

Borghesi, BARTOLOMMEO, COUNT, 1781–1860. Italian numismatist and antiquarian.

Borgia, CESARE, DUC DE VALENTINOIS, 1476–1507. Son of Pope Alexander VI.; cardinal 1492. He attempted to establish his power in the Romagna, which he filled with blood, poison, and hideous crimes.—His sister LUCREZIA, 1480–1519, thrice married, duchess of Ferrara 1500, was a patron of art and letters, and probably not as bad as she has been represented.

Boric or **Boracic Acid.** H_3BO_3. Made by treating borax with sulphuric acid. It is a crystalline solid, soluble in water and alcohol. When heated to 100° C. it is converted into metaboric acid, HBO_2; at 160° C. it yields tetraboric acid, $H_2B_4O_7$. It occurs free in nature and as salts, the principal one being borax. It is obtained from many of the fumaroles in volcanic



Boracic Acid Springs, Tuscany.

districts, particularly in Tuscany. It is used principally for the manufacture of borax, and in medicine. It is used in the antiseptic treatment of wounds, to cleanse unhealthy suppurating surfaces, to preserve solutions which decompose easily, and may be substituted in nearly all cases for carbolic acid. Internally it is rarely used, but is poisonous only in enormous quantities.

Boring. See DRILLING.

Boring Machine. Tool for making one or more holes in wood, driven either by a crank or by power. The holes may be bored horizontally, vertically, or at any angle. For metal-working, it is a tool for enlarging and bringing to exact dimensions a hole previously made. The work is secured to a table or plate, and the tool revolves, cutting at the sides of the hole; a drill cuts at the bottom of a hole. It is arranged with the boring-spindle either horizontal or vertical. The feed may be given to the boring-spindle, or to the table to which the work is fastened.

Boring Mill. Apparatus for driving a large bar carrying a head for boring large cylinders of steam-engines. The bar is usually vertical, driven by large gears overhead at the top, and turns the head which carries the cutters by a long spline cut through its entire length. The advance of the cutter-head is given by a screw, often driven by an epicyclic train from the driving gears. There are a number of cutters on the head, cutting on opposite ends of diameters, and the roughing and finishing cut is done at one traverse by setting the latter tools a little behind the plane of the former, and a little further from the center. When the boring of a large cylinder is once begun, it should be kept up without intermission. If any long stop were made, so that the metal of the cylinder could cool off, a shoulder would be found at the point where work was resumed. Cylinders should be bored in the position in which they are to work, or else the sagging of the metal, due to its weight, will make the bore untrue after boring.

Born, BERTRAN DE, ab. 1138–ab. 1215. French troubadour, called by Dante the poet of arms. His son and namesake also wrote verse.

Born, IGNAZ, BARON VON, 1742–1791. Austrian author of works on mineralogy, mining, and metallurgy; improver of the amalgamation process.

Börne, LUDWIG, 1786–1837. German journalist and critic, living in Paris from 1830. His collected works, 1862–63, fill 12 vols.

Borneil, GUIRANT DE, ab. 1150–1220. Provençal poet, called by Dante the poet of righteousness.

Borneo. Largest island on the globe, if Australia be excepted; between the China Sea and Indian Ocean, on the equator. Its length from n. e. to s.w. is 800 miles, its maximum breadth 680 m., and its area 284,363 sq. m., or one-tenth that of the U. S., excluding Alaska. The interior is traversed from n. e.

Borneo.

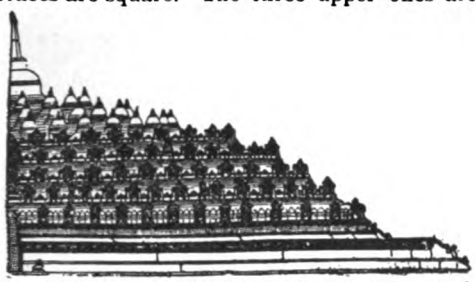
to s.w. by two parallel ranges of mountains, whose peaks rise to great elevations. Near the coast the land is low, and in many places, especially near the n. shore, marshy and unhealthy. It is peopled by Dyaks, the aboriginal inhabitants, Malays, Chinese, Japanese, Dutch, and English. It is still largely governed by the natives, though a British trading company has control of the north end of the island, and the remainder is nominally under English or Dutch protection. B. was discovered by the Portuguese 1518; visited by the Dutch 1598, who built a fort and a factory 1643, and another 1778. The first British settlement was made 1756. It furnishes gold, tin, zinc, antimony, iron, coal, and diamonds; estimated pop. 1,740,000.

Borneol. $C_{10}H_{18}O$. Mpt. 198° C. Borneo camphor. It occurs in nature and is produced from common camphor by the addition of hydrogen. It has an odor of pepper.

Bornite. $FeCu_3S_3$. Mineral containing ab. 60 per cent of copper combined with sulphur and iron; mined extensively in Chili. Also called purple copper, variegated copper, horse-flesh ore and peacock ore.

Boro Budor. In the Island of Java is the finest ruins of a Buddhist temple, dating from the 7th cent. A.D., but not finished till the 15th cent. A pyramid of terraces profusely decorated with reliefs and domed niches containing statues of

Buddha. The base measures 420 ft. each way, and the seven lower terraces are square. The three upper ones are circular



Half-elevation of one side of Temple of Boro Budor.

and are surmounted by a dome, under which is a relic chamber.

Borodin, ALEXANDER, 1834–1887. Russian physician and chemist, who composed chamber music, two symphonies, an opera, *Prince Igor*, and many works in smaller forms.

Borodino. Village on the Moskowa, Russia; scene of a desperate battle between Kutusoff and Napoleon, Sept. 7, 1812. The Russians retired with loss of 15,000 slain, 30,000 wounded and 2,000 prisoners. French loss, 12,000 dead, including 7 generals and 20,000 wounded. Result, an open road to Moscow for the French.

Boron. B, At. wt. 11, Sp. gr. 2.63. Discovered by Gay-Lussac and Thénard in France, and Davy in England, 1808. It occurs in boric acid and its salts. It is made by heating the oxide with potassium or aluminium; if the former be used the result is a greenish-brown powder, if the latter, crystals are formed, harder than corundum. It is converted by strong oxidizing agents to boric acid. It is both an acid-forming and base-forming element.

Boron Nitride, BN. White insoluble powder, made by heating borax and ammonium chloride together.

Borough. Anciently a fortified hill or castle and afterward the town that grew at its foot for protection. The burgesses or freemen of a borough enjoyed special privileges which the Reform Bill of 1832 destroyed. Borough now means a city, port, cinque-port or town-corporate whether sending representatives to parliament or not. In U. S. boroughs have a chief burgess, and a council who enact laws and govern the borough.

Borromeo, CHARLES, ST., 1538–1584. Abp. of Milan 1560; he reformed his clergy, suppressed Protestantism, showed heroism in the great plague 1576, and was canonized 1610.

Borrow, GEORGE HENRY, 1803–1881. English writer, specially on Gypsy life. *Zincali*, 1841; *Bible in Spain*, 1843; *Lavengro*, 1851; *Romany Rye*, 1857.

Borrowing-Days. Last three days of March; term originating in England to express the common belief that these are unusually stormy and are borrowed, as it were, from April; *i.e.*, the winds borrow from April the energy that they expend in March, leaving April weather comparatively quiet.

Borrow Pit. Excavation made for the purpose of obtaining earth to form an embankment elsewhere, the pit itself having no value. The quantity of earth removed from the pit is measured in place by means of levels taken before and after the work is done.

Bort, or BOORT. Variety of diamond, rough in appearance, not distinctly crystalline, and not transparent. It is harder than the crystallized diamond, is usually of a dark color, and is sometimes found in masses weighing several hundred carats. It is extensively used for drills and as a polishing and grinding material. Compare CARBONADO.

Borthwick, JANE, b. 1813. Scottish hymnist; tr. with her sister SARAH, MRS. E. J. FINDLATER, b. 1823, *Hymns from the Land of Luther*, 1854–62–84.

Bortniansky. See BARTNANSKY.

Boscan, JUAN, ab. 1493–1542. Spanish poet.

Boscawen, EDWARD, 1711–1761. English admiral, distinguished in the wars with Spain and France. He took Cape Breton 1756.

Bosnia. Province of Austrian empire, s. of R. Save and w. of Servia; settled by Slavic tribes ab. 500, held by Turkey 1522–1878. It has an area of ab. 20,000 sq. m. and a mixed population of ab. 1,400,000, of whom one-third are Mahommedans.

Bosphorus. Strait which unites the Black Sea with Sea of Marmora. It is ab. 16 m. long, with a breadth ranging from a quarter m. to two m., and a central depth of 148 to 388 ft. It was called of old the Thracian B., in distinction from the Cimmerian B., now Strait of Yenikade, which joins the Sea of Azof to the Black Sea.

Bosporus, KINGDOM OF. E. of Black Sea; founded 502 B.C., conquered by Scythians 285 and by Mithridates VI. 116. His son Pharnaces II. was conquered by Julius Cæsar at battle of Zela 47 B.C. (occasion of the "*Veni, Vidi, Vici*" dispatch). B. disappeared ab 344.

Boss. In mediæval architecture, an ornamented stone covering the junction of a number of moldings. Especially applied to the keystone of a vault, at which the ribs meet.

Bossi, GIUSEPPE, 1776–1816. Italian painter and poet.

Bossi, LUIGI, 1785–1835. Milanese author, prefect of archives under Napoleon. *History of Italy*, 19 vols., 1819–23.

Bossuet, JACQUES BENIGNE, D.D., 1627–1704. Bp. of Condom 1669 and of Meaux 1681. Noted for eloquence and of unbounded influence in the Gallican Church; a chief mover for the Revocation of the Edict of Nantes 1685. *Funeral Orations*, 1680; *Universal History*, 1681; *Variations of the Protestant Churches*, 1688.

Bos taurus. See BOVIDÆ and CATTLE.

Boston. Capital and largest city of Mass., at head of Mass. Bay. Its harbor is one of the finest in the world. It is the terminus of 9 railroads. The original city, which is very irregular, was upon the end of a peninsula, whence it has spread inland up the connecting neck and upon adjoining made land, the latter part being quite regularly laid out. It has also annexed several neighboring towns. Although its streets are in the main narrow and crooked, its municipal improvements are otherwise excellent. Its police and water departments, its water supply and sewer system, are in excellent condition. It has an admirable school system. Here are located the Mass.

Boston, Mass., in 1811.

Institute of Technology, the Boston Univ. and the Medical School of Harvard Univ. Boston is one of the great commercial cities of the world, handling over $100,000,000 of exports and imports annually. Its manufactures are very large and varied. It was founded 1630 by Puritan colonists under Winthrop, and in late Colonial times played a most important part in the development of the spirit of independence. Opposition to both the Stamp Act and the Tea Act centered here. Its port was closed 1774; the British army evacuated it March 17, 1776, after a year's siege. It became a city 1822. The fire of Nov. 9, 1872, swept over 65 acres in the business part and caused a loss of $75,000,000. In two years this same district was rebuilt with improvements. Pop., 1890, 448,477, one-third of foreign birth.

Boston. Game of cards, ranking and played as in whist, said to have originated in U. S. ab. 1780; is also played in Germany, England and France, and probably had its origin in the last. They are shuffled only at the beginning of the sitting, afterward cut only and then dealt 13 to each, 4, 4 and 5. Another pack is then cut by player opposite dealer for the trump, called first preference, the other suit of same color second preference, and the two others common suits. The elder hand first bids to play Boston with trump in any suit he chooses or to pass, and the other players outbid consecutively or pass; the second player must bid to play in same color as the trump turned, and the third player the trump turned. Rank of bids is, beginning with lowest, 5 tricks Boston, (1) common suit, (2) second preference, (3) first preference, 6 tricks (4), 7 tricks (5), Petit Misère, losing 12 tricks, one card being discarded (6), 8 tricks (7), 9 tricks (8). Grand Misère, lose every trick (9), 10 tricks (10), 11 tricks (11), Petit Misère Ouverte, discard 1 card, expose hand and lose 12 tricks (12), 12 tricks (13), Grand Misère Ouverte, lose every trick, hand being exposed (14), Grand Slam.

13 tricks (15). The bidder receives an increasing number of checks from each player for increasing bid if he wins and an additional increasing amount for tricks taken above his bid. On the contrary, he pays to each player, if he fails, an increasing amount according to the tricks lacking. From 5 to 13 tricks, the winnings from each player range from 12 to 166 white checks. On the contrary, his losings to each player range from 11 to 433. The Misères count respectively 20 to 160 from each player to the winner and the losings a like amount. The game is also played with a pool.

Boston Massacre. March 5th, 1770, by the city guard under Capt. Preston, who fired into a crowd, killing three and wounding others. Two of the soldiers were convicted of manslaughter.

Boston Museum OF FINE ARTS. Contains the best collection of casts from the antique in this country, and also of Greek vases and Oriental porcelains. Its Egyptian antiquities include the Hay collection and donations from the Egyptian Exploration Fund.

Boston Symphony Orchestra. Musical organization established by Henry Higginson, a banker, Feb. 1881, for the performance of high-class music. The conductors have been G. Henschel 1881, W. Gericke of Vienna 1884, A. Nikisch 1889, and E. Paur 1893.

Boston University. Chartered 1869. It embraces Coll. of Liberal Arts, Music, and of Agriculture (at Amherst), Schools of Theology, Law, and Medicine, and a School of All Sciences the last designed for post-graduate work. It has 118 instructors, ab. 1,100 students, and many scholarships.

Boston, THOMAS, 1677–1732. Scottish divine. His *Human Nature in its Fourfold Estate*, 1720, and *Crook in the Lot*, 1737, were long popular.

Boswell, JAMES, 1740–1795. Called by Macaulay "first of biographers." *Life of Samuel Johnson*, 1791.—His son, SIR ALEXANDER, of Auchinleck, 1775–1822, wrote Scottish songs, collected 1803.

Bosworth Field. In Leicestershire; site of the last battle between York and Lancaster, Aug. 22 1485. Richard III. was defeated and slain by the Earl of Richmond, who was crowned on the field as Henry VII.

Bot. See ŒSTRIDÆ.

Botanic Garden. First planted for medical purposes; one at Salerno 1309. For the study of botany, a private garden was founded at Padua 1530; and a public one at Pisa 1544. Before the close of that century Leyden (by Linnæus), Leipzig, Breslau, Montpellier, Heidelberg and Paris each had one. The influence of Linnæus increased the number, and governments and universities now universally recognize their educational value.

Botany. That branch of science which treats of plants. On account of its wide scope and great complexity, it has been separated into subdivisions. Structural Botany treats of the gross anatomy of plants; Plant Histology of their minute anatomy; Plant Morphology, of the forms of plants and their organs; Plant Physiology, of the functions of these organs; Systematic Botany, of the relationship and classification of plants; Geographical Botany, of the distribution of plants over the surface of the globe; Paleobotany, of the vegetable life of past ages and the successive appearance in the world of the great classes of plants, as traced in their fossil remains; and Economic Botany, which deals with the products of plants and their uses.

The field is so vast and the science has been so developed, through the labors of many eminent men, especially since the days of Linnæus (1707–1778), and is now being pushed so rapidly forward, that an intimate knowledge of the whole is removed beyond the powers of individuals. Yet any one of the branches of the science can be philosophically studied only in the light of all the others, making essential to the pursuit of any one a general knowledge of the whole.

The essential functions of plants are: first, the purification of the air by the withdrawal from it of carbonic acid gas, the retention of the carbon, and the restoration of free oxygen, thus rendering the atmosphere fit for the support of animal life; and, second, the production of food for the use of animals, chiefly in the forms of herbage, foliage, fruits, and seeds. Plants are the great organizers of inorganic matter, and, as this function is entirely absent in animals, the animal world could not maintain an independent existence.

The vegetable series presents an almost infinite variety of forms, from the lowly organized unicellular bacterium and green-slime, or still lower slime-mould, to the infinitely complex and majestic oak of the forest, yet so delicate is the structure, so accurate the adaptation to habits and surroundings in all, that one is scarcely more wonderful than another.

The unit of structure is the plant-cell. This consists of a cell-wall of cellulose containing during the active period, that which is the essential living portion, the protoplasm, a semifluid, transparent substance, endued with the power of motion, of absorbing fluids, secreting cellulose, and performing all the assimilative and metastatic functions of plant life under proper conditions. It also possesses the power of self-division through a denser portion called the nucleus of the cell, by which means the number of cells is increased, and, in the higher plants, the body of the plant is built up and formed and its various organs developed and matured. As the cell increases in age, especially in woody plants, the protoplasm gradually disappears, the wall thickens, and the cell becomes variously modified in form and function, remaining as an inactive and essentially dead portion of the plant body.

Plants are primarily classified as to their mode of reproduction, whether by spore or seed, into: I. The *Thallophyta*, with comparatively little differentiation of tissue and organs, consisting of the (a) *Algæ*, chlorophyll-bearing plants, inhabiting salt or fresh water, comprising the Sea-weeds, Pond-scums, and Diatoms; and (b) the *Fungi*, aërial or subterraneous plants occasionally growing within other plants or in animals, without chlorophyll, and living parasitically or saprophytically, *i.e.*, on living or dead organic matter, comprising the Mushrooms, Blights, Moulds, etc. II. The *Bryophyta*, the Liver-worts and Mosses. III. The *Pteridophyta*, the Ferns, Club-mosses and their allies. IV. The *Spermophyta*, divided into the *Gymnospermæ*, with the ovary open, and the *Angiospermæ*, with closed ovary, embracing the *Monocotyledonæ* and *Dicotyledonæ*; Monocotyledons have an embryo with a single cotyledon, stem mostly simple and endogenous, *i. e.*, with the woody bundles growing without regular arrangement throughout the stem, bark and wood not distinguished, leaves parallel-veined, floral parts chiefly in threes. In Dicotyledons the embryo has two cotyledons, the stem is mostly branched and exogenous, with the woody bundles of each period of growth in concentric layers from within outward, bark separable from the wood, leaves netted-veined, floral parts chiefly in fours or fives.

Reproduction among the flowerless plants is accomplished in many cases by both sexual and asexual spores, the manner of their formation being various in the different orders and intricate in detail. The asexual spores germinate quickly, and rapidly increase the number of individuals, while the sexual undergo a period of rest and germinate when the conditions become favorable.

In many an alternation of generations takes place, notably in the *Pteridophyta* the well-known leafy form of which bears asexual spores only in the sori or fruit-dots. These upon germination develop into a minute thalloid plant, the prothallium, which bears the sexual organs, and the matured sexual spore, germinating, produces the asexual plant.

The flowering plants, as has been said, reproduce regularly by seeds, though there are many examples of self-division, as in the rooting of stems, the budding of roots, and the dying off of the older portions of branching rhizomes, leaving the branches separate.

The essential portion of the seed is the embryo, having in Dicotyledons a caulicle and two cotyledons, which, with their point of junction, form the node, internode and leaves of the first phyton or element of which the plant body is composed. There is also between the cotyledons, at the apex of the caulicle, the plumule or bud from which the second phyton develops. The embryo may or may not be furnished with a supply of nutriment, stored either in the cotyledons or externally in the so-called albumen of the seed, and the whole is surrounded by a double protecting cover, the seed-coats.

Under proper conditions of heat and moisture the seed germinates, sending out from the tip of the caulicle the primary root, which turns downward into the soil, under the influence of geotropism, while the stem pushes upward to the light under the influence of the opposite force or negative geotropism. From this time there is a gradual and often rapid development of the tissues and organs of the plant till the point of flowering is reached and the plant produces seeds in all essentials like the one from which it sprang, thus completing the cycle of life.

The organs of the plant are all morphologically referable to three forms, the root, stem and leaf, but of these there are almost innumerable modifications for adaptation to various functions and conditions.

The root is most constant, and is usually an irregularly branched fibrous organ, at its growing tips actively absorbing the nutritious fluids of the soil, but it is sometimes thickened by a deposition of reserve material, as in the beet and carrot.

Stems, and branches, which are secondary stems, are either subterranean or aerial, and may be modified in the former case, as thickened rootstocks, bulbs, corms and tubers; in the latter, as thorns, spines, tendrils, floral axes or receptacles, runners, stolons, etc. Stems, as to their duration, may be annual, bi-

ennial or perennial; as to their character, herbaceous or woody; and as to their position, erect, inclined, decumbent, trailing or climbing.

Stems bear at their nodes the third form of organ, the leaf, in arrangement either opposite, alternate, or whorled. The axis or angle between the leaf and stem is the point of production of the bud, which is morphologically an undeveloped leafy stem, and is formed in summer to develop the following season.

In its ordinary character, as foliage, the leaf consists of three parts, any of which may be wanting; viz., the petiole or leaf-stalk, the lamina or blade, and a pair of leafy appendages at the base of the petiole, known as stipules. The most important part of the leaf, and therefore least frequently absent, is the blade, which consists of a framework of woody bundles, supporting the soft tissue, the cells of which are loosely arranged and abundantly supplied with chlorophyll, the green coloring matter of the leaf, which, in the presence of sunlight enables the protoplasm of the cells to break up the gaseous and fluid substances absorbed by the leaves and root, and to recombine their elements as starch, the primary assimilative food product of the plant.

The intercellular spaces of the leaf communicate freely with the air by means of the stomata or breathing pores, which have the power of opening and closing according to external conditions and are usually most abundant on the lower surface of the leaf and often wholly wanting above. This enables the leaf readily to absorb the useful gaseous elements and to throw off the unused oxygen.

The leaf is variously modified as bulb, bud, and involucral scales, scales of rhizomes and tubers, spines, tendrils, bracts, etc., but especially in the flower, the reproductive organ of the plant, in which the sepals, petals, stamens and the carpels of the pistil are modified leaves. Of these the stamens and pistils only are essential organs and may be together in the same flowers (perfect), or in different flowers on the same plant (monœcious), or on different plants (diœcious). The stamen consists of the filament and anther, in the latter of which are produced pollen grains, the male reproductive spores. The parts of the pistil are the ovary, style and stigma. Within the ovary, upon the placentæ, which are formed by the margins of the modified carpellary leaves and may vary in number and position with the number of carpels and their mode of compounding, are borne the ovules, minute sac-like bodies with an open pore or foramen and containing the germinal vesicle or female reproductive body. Fertilization takes place by the falling of the pollen upon the moist surface of the stigma, where it germinates and sends down a tube through the loose tissue of the style and the foramen of the ovule to the germinal vesicle, where it unites its protoplasm with that of the latter. Immediately a new growth begins which ends in the development of the ovule into a seed.

The floral envelopes, the calyx and corolla, are protective, or, by their bright colors and associated nectar glands, attractive to insects, upon whose visitation many plants are entirely dependent for fertilization (entomophilous). Either or both may be wanting, as in plants dependent for fertilization upon the winds (anemophilous). Flowers may be solitary or variously grouped in clusters; *e.g.*, the raceme, cyme, corymb, umbel, spike, catkin, head, fascicle, glomerule and panicle.

At the maturity of the seed occurs also the ripening of the fruit in which the seeds are inclosed. It may consist of the ovary only or may include, as in many fleshy fruits, the calyx, receptacle, and even bracts.

Fruits may be classified as dry and fleshy. The former may be dehiscent (capsule, silique, silicle, legume, follicle and pyxis), or indehiscent (achene, caryopsis, samara and nut). The dehiscent forms are usually many-seeded, the indehiscent one-seeded. Fleshy fruits include the pome, drupe, berry and pepo. To many seeds are attached feathery, cottony or wing-like appendages, to assist in distribution by the wind, or prickles and hooked spines to aid in distribution by animals.

In the distribution of plants over the earth numerous floral regions may be distinguished. The marine flora is mainly of *Algæ;* the fresh water, of *Algæ*, a few flowerless plants and the aquatic flowering plants; the terrestrial of *Fungi*, and the most of the higher Cryptogams and flowering plants. In the tropics the vegetation is most luxuriant; in temperate regions less so, but in general more robust; in the frigid zones only the most hardy plants can exist. Through three corresponding regions we may also pass altitudinally from sea-coast to mountain-top. There are also great forest regions, as those of northern and eastern America and northern Europe and Asia; great arid regions whose vegetation is dwarfed and scanty, as those of northern Africa, central Asia and our own Great Interior Basin; and great prairie regions, inhabited by grasses and other campestral forms, of which our western prairies, the pampas of S. America and the steppes of Asia are examples. But similar regions, while having floras similar in kind, usually differ widely in the species and even in the genera represented. There are, however, frequent examples of widely separated regions with floras unusually similar, and for explanation of these cases we must go back to the history of ancient geographical distribution in the records of Paleobotany.

The value of the science of Botany cannot be overestimated. We are dependent upon the plant world for pure air, either directly or indirectly for food and clothing, for much of our building material, and for unnumbered necessities and comforts of life. It embraces a large part of the science of medicine, the science and art of agriculture, of horticulture, the raising of fruits and vegetables, and the feeding of cattle. Nor must its importance and great value as a means of education, of mental and moral development, be overlooked. Its study trains the mind to accurate observation and careful investigation. It leads to a knowledge of the beauties and the wonderful harmony of nature and arouses for them that love which has always been so great a power for good.

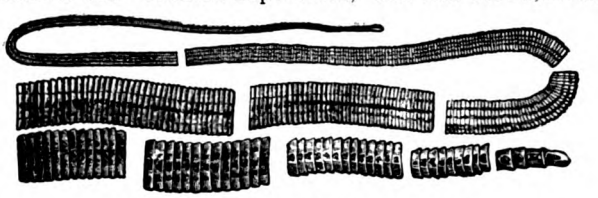
Botany Bay. Inlet in N. S. Wales, Australia, discovered 1770; name transferred with the penal station to Port Jackson 1788. Convicts were sent here from England 1787–1840.

Botelho de Oliveira, MANOEL, 1636–1711. Brazilian poet.

Both, JAN, 1610–1656. Dutch landscape painter who traveled in France and Italy; significant for the influence of Claude Lorrain on Dutch art.—His brother, ANDREW, 1610–1650, was closely associated with his work.

Bothnia, GULF OF. Large arm of the Baltic Sea, separating Russia from Sweden.

Bothriocephalidæ. Family of Tape-worms, including forms whose segments remain together so as to make the long tape-worms common in Europe, often 30 feet in man. *Bothriocephalus* is the "Russian Tape-worm," and has over 3,000 segments. Each is short, but as the worm is an inch in width each contains many eggs that escape from a pore on the flat side. The segments are thrown off in groups, and the eggs develop in water; the larvæ make their way into the Pike and other fresh-water fishes, and thus are introduced into the intestine of man.



Bothriocephalus.

Bothriolepis. Placoganoid Devonian fish with pitted plates; one of the earliest recognized of the Devonian fishes of America.

Bothrocidaridæ. See TESSELLATA.

Bothrophera. Division of *Solenoglypha*, characterized by the presence of a pit between the eye and nostril, as in the rattlesnake.

Bothwell. Village 8 miles e. of Glasgow. Here the Covenanters were defeated by the Duke of Monmouth June 22, 1679.

Bothwell, JAMES HEPBURN, ab. 1526–1578. Third husband of Mary Stuart 1567; supposed murderer of Darnley; soon after expelled from Scotland and died in a Danish prison.

Botrydiaceæ. Small order of *Algæ*.

Botryllus. See ASCIDIANS.

Botryoid. Resembling a bunch of grapes.

Botryose. Forms of anthotaxy or inflorescence in which the main axis is not terminated by a flower. Known also as indefinite, indeterminate and centripetal inflorescence. A flower cluster of this kind is called a raceme or botrys.

Botta, CARLO GIUSEPPE GUGLIELMO, 1776–1837. Italian historian, long resident in Paris. His *History of Italy*, 20 vols., 1832, supplement Guicciardini, and extends from 1535 to 1814.—His son, PAUL EMILE, 1802–1870, French consul at Alexandria and Mosul, began excavations in Assyria 1843, preceding Layard, and pub. *Monuments of Nineveh*, 5 vols., 1847–50. He brought many antiquities to the Louvre.

Botta, VICENZO, Ph.D., 1818–1894. B. in Italy. He came to America 1853 and was long prof. Univ. N. Y. *Cavour*, 1862; *Dante*, 1865.—His wife, ANNE CHARLOTTE (LYNCH), 1820–1891, pub. *Poems*, 1848, and a *Handbook of Universal Literature*, 1860.

Bottesini, GIOVANNI, 1822–1889. Italian composer and conductor, especially distinguished as virtuoso on the double-bass. He used an instrument with three light strings and a bow patterned after that of the violoncello.

Botticelli, SANDRO, 1446–1510. Florentine artist of the early Renaissance; real name Alessandro di Mariano Filipepi; noted for imaginative quality. He has fine madonnas in the National Gallery, Louvre, and Florence collections, and frescoes in the Sistine Chapel. His mythological pictures are among the very earliest of this class. *Birth of Venus*, *Triumph of Calumny* in the Uffizi, and *Spring* in the Florence Academy.

Bottle-brush Flowers. In Australia, flowers of shrubs of the genera *Melaleuca* and *Callistemon*, of the Myrtle family.

Bottle-brush Grass. *Asprella Hystrix.* Woodland grass of n. e. N. America.

Bottle-Grass. *Chamæraphis viridis.* Native grass of Europe, introduced as a weed into the U. S.

Bottle-Tree. *Sterculia rupestris.* Large tree with a swollen stem, native of Australia; natural family *Sterculiaceæ.*

Bottomry. Written contract, generally in the form of a bond, hypothecating or binding a ship for the repayment of money advanced for its benefit, in case it reaches its destination. As the money is not to be repaid if the ship is lost, but is loaned upon maritime risks, a high rate of interest is allowed; usury laws do not cover such loans.

Boucher, FRANÇOIS, 1703–1770. French decorative and mythological painter, superficial but brilliant, a poor colorist, with a fine sense for architectural balance.

Boucher de Crèvecœur de Perthes, JACQUES, 1788–1868. French anthropologist and archæologist; discovered flint implements in the drift gravels of the Seine in 1841, by which the antiquity of man was first clearly established. From this discovery dates the knowledge and study of the STONE AGE (q.v.).

Boucicault, DION, 1822–1890. Irish-American dramatist, actor and manager. *The Colleen Bawn*, 1860; *The Octoroon*, 1861; *The Shaughraun*, 1876.

Boufflers, LOUIS FRANÇOIS, DUC DE, 1644–1711. French general. He served with distinction in Holland, Germany, and on frontiers of Spain; defended Namur against William III. 1695, and Lille against Prince Eugene 1708, and conducted the retreat from Malplaquet 1709.

Bougainville, LOUIS ANTOINE DE, 1729–1811. French seaman. He circumnavigated the globe 1767–69 and bore part in the American war.

Bought-Note. A written memorandum of a contract of sale, delivered by the buyer to the seller; if the contract is made through the intervention of a broker, he generally delivers it to the buyer.

Boughton, GEORGE HENRY, b. 1834. Subject painter of English birth, resident in America 1837–60; N.A. 1871, A.R.A. 1879. Several of his pictures are subjects from the early Puritan days of New England.

Bougies. Instruments, usually made of rubber, used to pass into the urethra in cases of tight stricture, less liable to inflict injuries than metallic sounds or catheters.

Bouguer, PIERRE, 1698–1758. French physicist, sent with others to S. America 1735, to measure a degree of the meridian at the equator; they remained seven years and made valuable observations on the length of a second's pendulum in high altitude, and on the deviations of the plumb line due to a neighboring mountain, etc., and laid the foundation of photometry. He invented a heliometer, afterward improved by Fraunhofer. *Figure of the Earth*, 1749; *Optics*, 1760.

Bouguereau, ADOLPHE GUILLIAUME, b. 1825. French historical and genre painter.

Boulak Museum. See GIZEH.

Boulanger, GEORGES ERNEST JEAN MARIE, 1837–1891. French demagogue and agitator, General 1880, Minister of War 1886. He enjoyed for a time an unfounded and dangerous popularity, but escaped to England 1888 to avoid arrest, was tried and sentenced while absent, and committed suicide in Belgium.

Boulder-Clay. Bed of tough stony clay, forming the lower part of the unstratified drift. It is believed by some to have been deposited in water, and by others to be a deposit formed beneath the glacier above sea level. Many of the stones in it bear the characteristic striation of ice-action. Few fossils are found in it, and these are believed by one party to be intrusive, while another maintains that they represent the life of the time and of the glacial sea.

Boulders, or ERRATIC BLOCKS. Loose stones of large size found scattered over the surface or buried at a small depth in the loose superficial deposits, which are regarded as relics of the Ice Age and consist usually of rock foreign to the locality in which they are found. They occur over the northern parts of Europe and N. America, and form one of the most important evidences of a Glacial Era. They often present little trace of wearing, though frequently they have been transported for hundreds of miles. They are occasionally of enormous size, and when distant from a mountain range the direction of their travel is almost uniformly southward. On a broad view, however, they really radiate from certain centers of distribution, the chief of which for e. N. America lay near Hudson Bay.

Boulé. Legislative council or senate of Athens, consisting of 400, and, later, of 500 members. It was divided into ten sections of 50 each, which presided in turn. It suggested laws for the action of the popular assembly of all the citizens.

Boulogne-Sur-Mer. City and seaport of France, at mouth of R. Liane; a well-known seaside resort, especially for English people. It was taken by Henry VIII. Sept. 14, 1544, and restored 1550. Napoleon assembled a large army here to invade England 1804. Pop., 1891, 45,205.

Boulogne-Sur-Seine. Suburb of Paris. Pop., 1891. 32,569.

Bouncing-Bet. *Saponaria officinalis.* Plant of the Pink family, native of Europe, but widely diffused by cultivation, and naturalized as a roadside weed in N. America; called also Soapwort.

Bouncing-Bet (*Saponaria officinalis*).

Boundary. Dividing line between contiguous lands. If land is bounded by a non-navigable stream, the center line is meant; if by a navigable stream or the sea, the high-water mark generally—in Mass., the low-water mark; if bounded on a highway which is owned by the State or Municipality, the contiguous side of the highway is meant, otherwise its center line.

Bounty. Sum granted by the Government to producers of certain articles in proportion to the amount produced or exported, in order to stimulate domestic industry or for other indirect ends. Also, money paid to men to enter the navy or army, and for killing of wild beasts.

Bounty, MUTINY OF THE. April, 1789. The officers of the *Bounty*, an English vessel in the W. India trade, were set adrift in the launch. A portion of the mutineers landed at Tahiti, and were afterward executed; the remainder took possession of PITCAIRN'S ISLAND (q.v.).

Bourbaki, CHARLES DENIS SAUTER, b. 1816. French general at Metz and elsewhere 1870–71; retired 1881.

Bourbon, CHARLES DE MONTPENSIER, DUC DE, 1489–1527. Constable of France 1515. Stung by neglect and wrongs, he renounced allegiance to the king and joined Charles V. 1523, inflicted a disastrous defeat on the French at Pavia 1525, and was killed in a successful assault on Rome.

Bourbon, HOUSE OF. Founded by Adhemar ab. 900. Louis I. was created duke of B. 1327; Henry IV., descended from a younger son of Louis, became king of France 1589, and was followed by Louis XIII.–XVI.; overthrown by revolution 1789; restored in Louis XVIII. 1814–15, and ended by deposition of Charles X. 1830. The Orleans branch reigned in Louis Philippe 1830–46. A younger branch received the crowns of Spain 1700, and that of Naples 1759; expelled from Spain 1868; restored 1874. The Neapolitan line ended with Francis II. 1860.

Bourdaloue, LOUIS, 1632–1704. French Jesuit; eminent preacher.

Bourdon, EUGENE, 1808–1884. Inventor and manufacturer of a special form of aneroid and manometer.

Bourgeoisie. Originally the middle class of citizens in France, now the employing class as distinguished from the employed; the capitalists as opposed to wage earners.

Bourges. City of France, at junction of the Rivers Auron and Eure. Pop., 1891, 45,432.

Bourget, PAUL, b. 1852. French critic, poet and novelist. *Etudes*, 1883–89; *Mensonges*, 1887; *Cœur de Femme*, 1892; *Outre Mer*, 1895.

Bourignon, ANTOINETTE, 1616–1680. Flemish mystic, who left the R. C. Ch., had "revelations," wrote books and won converts, especially in Scotland.

Bourne, VINCENT, ab. 1695–1747. English author of Latin poems 1734; some were tr. by Cowper.

Bournonite. $CuPbSbS_3$. Mineral containing lead, antimony, copper and sulphur.

Bourrée. Old dance of undetermined origin, allied in character to the GAVOTTE (q. v.), but in rapid alla breve time. It is used in the old SUITES (q. v.).

Bourrienne, LOUIS ANTOINE FAUVELET DE, 1769–1834. Sec. and biographer of Napoleon. *Memoirs*, 10 vols., 1829–31.

Bourse. Continental exchange; association of men who buy and sell stocks and other securities on their own account, or for others. Business is transacted for a commission. The first gathering of the kind was in the house of Van der Bourse, at Bruges. See EXCHANGE.

Boussingault, JEAN BAPTISTE JOSEPH DIEUDONNE, 1802–1887. Member Institute of France. *Relation of Climate to Agriculture; Temperature of the Soil and Ocean; Chemical Constitution of the Atmosphere.*

Bouterwek, FRIEDRICH, 1766–1828. Prof. at Göttingen from 1797. *History of Modern Poetry and Eloquence*, 12 vols., 1801–19. The Spanish portion of this work was tr. and enlarged by Cortina and Molinedo 1828 and tr. into English 1847.

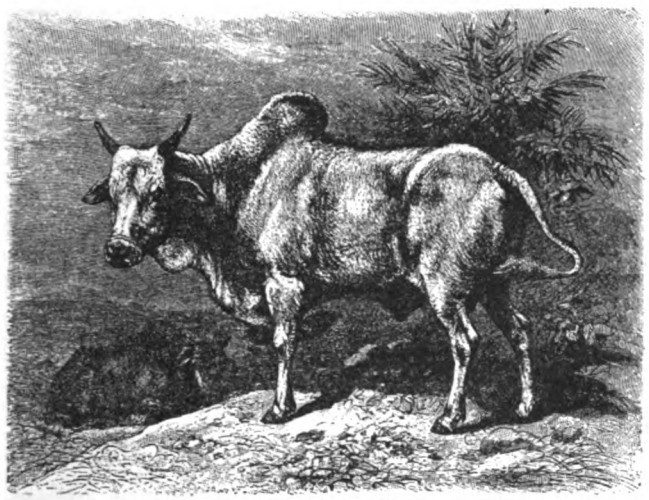
Boutwell, GEORGE SEWALL, LL.D., b. 1818. Gov. of Mass. 1851–2, M. C. 1863–69, Sec. Treas. 1869–73, U. S. Senator 1873–77.

Bouvart, ALEXIS, 1767–1843. Swiss astronomer; member of the Bureau of Longitude and Academy of Sciences in Paris; Laplace's assistant in the *Mécanique Céleste*, author of tables of Jupiter, Saturn and Uranus. Discussion upon the latter led to the discovery of Neptune.

Bouvier, JOHN, 1787–1851. B. in Italy; judge in Phila. 1838. *Law Dictionary*, 1839; *Institutes of American Law*, 1851.

Bouvignes. Village of Belgium, scene of victory of Philip Augustus, July 27, 1214, over Otho IV.

Bovidæ. Ox family of the Cavicorn Ruminants. The horns are directed outward and not twisted spirally, as in the *Ovidæ*. The Domestic Cattle (*Bos taurus*) are supposed to have descended from wild forms formerly existing in Germany. The Zebu of the Orient is known only in the domestic



Zebu (*Bos Indicus*).

state. It possesses a hump of fat over the withers and is often hornless. The Bison includes the nearly extinct Aurochs of Europe and the Buffalo of America. The true Buffalo (*Bubalus*) has large triangular horns with broad bases; it occurs in Africa and southern Asia. The Yak of Thibet has long silken hair on the shoulders, flanks and thighs. The Musk Ox, now restricted to Arctic regions, is nearly allied to the Sheep. It has a massive body, short legs and long hair, and the horns in their curvature approach the Sheep type.

Bovine Tuberculosis. Disease affecting ab. 3 per cent of all cows; especially prevalent in large dairy herds subjected to forced feeding and milking and poor ventilation, especially if high bred; the same as human consumption. The germ (*Bacillus tuberculosis*) peculiar to this disease may be present in the milk of a tuberculous cow. Cases of infection of children in this way are known. It is, therefore, the duty of dairymen to test their herds with Koch's lymph, the only sure way of detecting the diseased animals, which should be slaughtered and buried or burned.

Bowditch, NATHANIEL, LL.D., F.R.S., 1773–1838. American mathematician, actuary Mass. Life Ins. Co. 1823. He pub. *The Practical Navigator*, 1802, and tr. Laplace's *Mécanique Céleste*, 1829–39.—His son, NATHANIEL INGERSOLL, 1805–1861, pub. his *Memoir*, 1839, and *Suffolk Surnames*, 1857–61.

Bowdler, THOMAS, 1754–1825. English ed. of *The Family Shakespeare*, 1818, purged of all obnoxious expressions, hence the epithet "bowdlerized," *i.e.*, expurgated. A similar ed. of Gibbon appeared 1826.—His son, JOHN, 1783–1815, a promising poet, wrote hymns and other *Select Pieces*, 1816.

Bowdoin, JAMES, 1727–1790. Gov. of Mass. 1785–87. Shay's Rebellion occurred during his term.—His son and namesake, 1752–1811, was a benefactor of B. Coll. and envoy to Spain 1805.

Bowdoin College. At Brunswick, Me., chartered 1794, opened 1802. The Medical School of Me., founded 1820, is connected with it, and has 13 instructors and ab. 100 students. The college proper has 25 in the faculty, and ab. 270 students; there were, in 1894, 2,504 academic besides 1,607 medical graduates. It offers three post-graduate courses, and has a gymnasium, and a library of 50,000 vols. Its centennial was celebrated 1894.

Bowen, FRANCIS, LL.D., 1811–1890. Ed. *N. Am. Review* 1843–54; prof. Harvard 1853. *Political Economy*, 1856-70; *Logic*, 1864; *Modern Philosophy*, 1877.

Bower, ARCHIBALD, 1686–1766. Scottish Jesuit who left the R. C. Ch. 1726 and again 1747. *History of the Popes*, 7 vols., 1748–66; continued by S. H. Cox, D.D., 1844–5.

Bower-Birds. Peculiar to Australia and adjacent islands. The largest is *Ptilonorhynchus violaceous*, as large as a crow, the male purplish black, the female grayish green. Before nesting, they build galleries of twigs, ornamented with bright shells and other objects. *Amblyornis inornata*, a bird of the size of a robin and rather plain in color, builds conical houses half a yard high and a yard in diameter. A central stem is chosen and strengthened by additions of moss about the base, and then the twigs of an epiphytal orchid are placed like rafters in a circle about this center-pole. The roof thus formed is thatched to keep out rain. Then the yard in front of the cabin is cleared, planted with moss on which bright objects are arranged as if to form a flower garden. Objects that lose their color are replaced by new and brighter ones; fruits, flowers, insects, shells, fungi, and any brilliant objects are chosen. See DENTIROSTRES.

Bowhead. See BALEEN WHALE.

Bow-Legs. Condition in which the legs below the knees are crooked and not in the same line as the thighs; congenital, a race characteristic, or acquired by allowing a child to rest its weight upon the legs too early in life; if not neglected, curable by braces.

Bowlines. Lines made fast to the sides of sails to haul them forward so as to enable the ship to sail nearer to the wind.

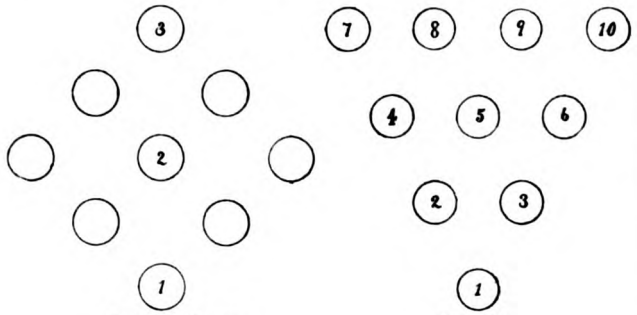
Bowles, SAMUEL, 1826–1878. Ed. Springfield, Mass., *Republican* from 1844. *Our New West*, 1869.

Bowles, WILLIAM LISLE, 1762–1850. English poet and divine; voluminous writer and ed. of Pope 1807.

Bowls, or Bowling. English game played with large solid balls of hard wood, which are rolled at a small white ball called a "jack" upon a level plat of greensward called a bowling-green. The game has been traced back to the 12th century, and was doubtless originally played in the open air, though later under covered sheds and finally upon alleys within doors. The original bowls or balls were stone bowlders as nearly spherical as could be procured. *Bowling* is the name applied in the U. S. to the game of "tenpins" (originally ninepins) played upon a wooden alley. This game, which resembles the English skittles, was derived in America from the Dutch. Bowling Green, N.Y., was leased for this game in 1732. It was originally played in the open on an alley bed of clay. In later times, a single board ab. one foot in width was laid in the clay. The game reached its highest popularity in America between 1840 and 1850, and is still widely played upon improved wooden alleys, according to rules drafted by a National Bowling Association. The game consists of rolling a wooden ball along an alley and endeavoring to knock down pins set up at the end. A regulation alley is 60 feet long and 42 inches wide. The pins are set in a triangular position, the point facing the bowler, and each pin 12 inches from the next. The runway is 15 feet long. The bowler is allowed three balls to each frame. Should the first ball knock over all the pins, he is credited with a strike (+), which is marked in the upper righthand corner. Should it require two balls to remove the ten, he scores a spare. If it requires all three balls it counts 10, and is called a break; but if, after the three balls have been rolled, pins are still left standing, the bowler scores as many points as he has knocked down pins. The following diagram illustrates the scoring:

Player.	1	2	3	4	5	6	7	8	9	10
Mr. Smith	8 \ 23	44								

His first ball knocked down eight pins, but his other two missed. On his second frame his first two balls knocked down the ten, thus giving him a spare ball. With this he starts in on his third frame and knocks down five pins. He had 10 already; the spare makes 15, which, added to his first frame, gives him 23; this is set down under the second. But he is still on his third frame and proceeds in the same fashion with his balls, the spare ball in the second counting the same number of pins in the third frame. There are now two balls left with which to remove the remaining pins. On the second ball he again removes all the pins and counts a spare. With the next ball he scores six pins added to the ten already made as indicated by the spare in the third frame, gives him a total of 21 added to the score of the second frame gives the score for the third frame 44. So it continues through ten frames. Technical terms are as follows:



Head Pin Game. Ten Pins.

Dead Wood. Pins which have been bowled down but remain either on the alley or in the pin pit.

Poor Mark. Horizontal line drawn across the alley 60 feet from the head pin spot.

Gutter. Trough on side of alley.

Hofted Ball.—One which, after leaving the player's hands, bounds on the alley.

Poodle.—A ball that rolls into the gutter before reaching the pins.

Other games played in the same form of alley are numerous, the most important are:

Cocked Hat.—Pins 7, 10, and 1 are set up.

Cocked Hat and Feather.—Pins 7, 10, 5, and 1 are set up. The object is to leave the feather-pin No. 5 standing.

College Game.—Pins 5 and 1 are set up and an additional pin 12 in. in front of No. 1, known as the "picket" pin. Here again the picket pin is to be left standing.

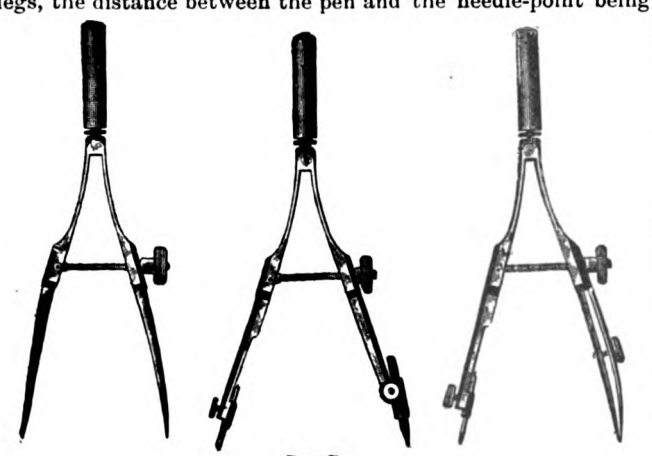
Newport Game. All pins set up and the object is to knock down a certain number of pins from 1 to 10.

Head Pin Game.—See diagram. Nine pins are set up, the game divided into four frames, and the bowler allowed four balls to each. The object is to knock down the head pin first; all pins falling in consequence are counted.

Other games are *The Glen Island, Seven Up, Nine Pins Head Pin Out, T Game, Pin Pool, Nine Up, Nine Up and Nine Down, Head Pin, Four Back, Five Back, White Elephant, Open Game,* and *Seven Down.*

Bowman's-Root. *Porteranthus trifoliatus.* White flowered plant of the Rose family, native of n. e. N. America.

Bow-Pen. Compasses used by draftsmen, having spring legs, the distance between the pen and the needle-point being regulated by a screw. The figure shows a bow-spacer, a bow-pencil, and a bow-pen.


Bow-Pen.

Bowring, Sir John, LL.D., 1792–1872. English poet and linguist; ed. *Westminster Review,* 1825; M. P. 1835–7, 1841–9, knighted 1854, gov. of Hong Kong 1854. His *Matins and Vespers,* 1823, and *Hymns,* 1825, contain many good lyrics. Tr. Russian, Dutch, Spanish, Polish, Servian, Hungarian, and Bohemian poetry 1821–30. *Decimal Coinage,* 1854; *Siam,* 1857; *Reminiscences,* 1877.

Bowstring-Truss. Bridge-truss whose upper chord is curved like a bow and whose lower chord is straight like the string of a bow; much used for highway bridges of short span on account of its graceful appearance. The stress in the lower chord is nearly uniform throughout, and the stresses in the bracing are smaller under uniform levels.

Bowtell. In mediæval architecture, a round molding or bead.

Bow-Wood. See Osage Orange.

Bowyer, Sir George, D.C.L., 1811–1883. *English Constitution,* 1841; *Universal Public Law,* 1854; *Civil Law,* 1874.

Boxberry. See Wintergreen.

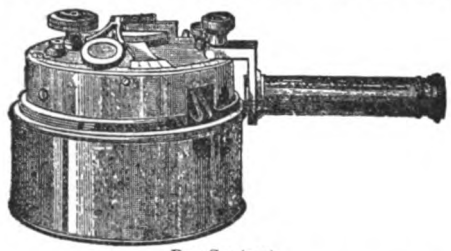
Box-Culvert. Formed by two side walls covered by flat stones so that its cross-section is rectangular; used for drains under embankments where the discharge of water is small. A double box-culvert has two rectangular openings, separated by a vertical wall.

Box-Elder. *Acer Negundo.* Small tree of the Maple family, native of N. America.

Box-Girder. Made up of wrought-iron plates and angle-irons, and so arranged that its cross-section approximately resembles a hollow rectangle. A tubular bridge is a box-girder on a large scale.

Boxhauling a Ship. Process of veering a ship when tacking is made impracticable by the swell of the sea.

Box-Sextant. Small pocket sextant arranged with a cover, so that when closed it resembles a round box; used by surveyors in hydrographic and topographic work.


Box-Sextant.

Box-Tree. Several species of *Buxus,* a genus of evergreen shrubs and small trees of the Spurge family, natives of Europe and Asia, much planted for ornament. In Tasmania, *Bursaria spinosa;* in N. S. Wales, *Pittosporum undulatum;* both trees of the family *Pittosporaceæ.*

Boy-Bishop. Mediæval choir-boy who Dec. 6 to 28 was vested in Episcopal robes, with miter and crosier, and sang the Mass (except the Consecration). If dying then, he was buried as a bishop.

Boyce, William, Mus.D., 1710–1779. Chiefly known by his book, *Cathedral Music,* 3 vols., 1760–78.

Boycotting. Combination by two or more to injure others by coercing third persons against their will to abstain from beneficial business intercourse with the boycotted. It gives the injured person an action for damages against the boycotters and generally subjects to criminal prosecution.

Boyd, Andrew Kennedy Hutchison, D.D., LL.D., b. 1825. Minister of St. Andrews, long known as "A.K.H.B." initials signing his *Recreations of a Country Parson,* 1859–78.

Boyësen, Hjalmar Hjorth, b. 1848 in Norway. American novelist; prof. Cornell 1874, and Columbia, N. Y., since 1880. *Gunnar,* 1874; *Falconberg,* 1878; *Idyls of Norway,* 1882; *A Daughter of the Philistines,* 1883. Also *Goethe and Schiller,* 1879; *Story of Norway,* 1884; *Commentary on Ibsen,* 1894.

Boyle, J. J., b. 1857. American sculptor. *Indian,* Lincoln Park, Chicago; *Aerial Navigation,* Columbian Exposition, 1889.

Boyle, Robert, 1627–1691. Irish experimental physicist and chemist, resident at Oxford 1654, London 1668; one of the founders of the Royal Society. Made important researches in pneumatics, including an improvement in the air-pump. His greatest contribution to chemistry was to point out its real aim, the study of the composition of substances. He was the first to give a clear meaning to the terms element and compound. Many of his papers were pub. in the *Philosophical Transactions. Works,* 5 vols., 1744. He wrote much on religion, and founded the B. Lectures for its defense.

Boyle, Law of. Announced 1682, that the volume occupied by any definite amount of an elastic gas, like the air of the earth's atmosphere, varies inversely as the pressure, provided its temperature be kept constant: it is common in modern physics to express this law by saying that "pressure x volume =a constant," or that the variation of P x V = O. Exact modern measure shows that d(PV)>O or positive for small pressures and <O or negative for high pressures. This law is also known as the Boyle-Mariotte law. See Mariotte.

Boyne. River entering Irish Sea, n. of Dublin. William III. here defeated James II. July 1, 1690.

Bozzaris, Marco, ab. 1790–1823. Greek leader, killed in a successful attack on the Turkish camp, and celebrated in a poem by Halleck.

Brabant. Mediæval duchy, held in whole or part by Charles V. and his successors; occupied by Dutch, Flemings, and Walloons; divided 1814 into three provinces, of which in 1830 North B. became part of the Netherlands, and Antwerp and South B. of Belgium.

Brabourne, Edward Hugessen Knatchbull-Hugessen, Lord, 1829–1893. English M. P. and official, made a baron 1880; writer of juvenile tales.

Braccate. Feet of a bird, feathered on toes and tarsus, as in the Snowy Owl.

Brace. Beam or bar in a bridge truss placed in an inclined position between the chords; or any timber used to stiffen a structure.

Brace, Charles Loring, 1826–1890. Founder N. Y. Children's Aid Society 1853. *Hungary*, 1852; *Norse Folk*, 1857; *Dangerous Classes of N. Y.*, 1872–80; *Gesta Christi*, 1882; *The Unknown God*, 1890.

Braced Arch. A metal arch consisting of two ribs or arches, connected by diagonal bracing. The largest ever built is the 515 ft. span of the St. Louis bridge.

Bracelet-Wood. In W. Indies, *Jacquinia armillaris*, small tree of the natural family *Myrsinaceæ*. Its seeds are used for bracelets.

Braces. Ropes by which the yards are turned about to bring the sails to the wind.

Brachial Appendages. "Arms" of Brachiopods; labial appendages, prolongations of the lateral margins of the mouth.

Brachialia. (1) Cartilages in base of pectoral fins of fishes, to which rays are attached. (2) Joints in the branches on the "radials" of a crinoid's arms, bearing divisions called palmars.

Brachiferous Disc. Of discophorous Jelly-fishes. In Rhizostomes, the wall bends in, forming a false velum, which grows to, and fuses with, the oral arms, leaving four chambers above, roofed by the subumbrella. The floor thus formed becomes perforated, and is the brachiferous disc.

Brachiolaria. Starfish larva like the *Bipinnaria*, but having, in addition, a set of unciliated arms on the mouth end.

Brachiopoda. Lamp-shells, Palliobranchia. Fixed *Molluscoidea*, with anterior (dorsal) and posterior (ventral) shell-valves lined by a mantle. The latter valve is the larger, and is either fused to foreign objects or perforated by a special pe-

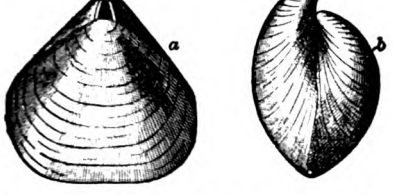


Fig. 1.—*Rhynchonella psittacea* seen from the dorsal aspect (*a*) and from the side (*b*).

Fig. 2.—Interior of the smaller (dorsal) valve of a Brachiopod shell (*Waldheimia*), showing the limy framework which supports the arms.

duncle. Two spirally coiled arms, bearing ciliated cirri, are borne on each side of the mouth and supported by a calcareous frame-work from the dorsal valve. The sexes are generally separate. There are two orders: *Ecardines* and *Testicardines*. This class are of interest in palæontology on account of their predominance in palæozoic ages. Comparatively few species now exist. They differ from the Lamellibranchs in having their two shells placed dorsally and ventrally instead of laterally. Many species also possess a calcareous skeleton for the attachment of some of the internal organs, and which in some of the fossil genera attained great complexity and beauty, as is proved by very perfect specimens not infrequently found in a silicified condition. Spirifers are the most remarkable of these.

Brachistochrone, or Brachystochrone. Line along which a body acted upon only by gravity will move from one point to another in the shortest time; called the curve of quickest descent.

Brachium. (1) Upper arm of Vertebrates. (2) Ray or branch of the Crinoid's arms, bearing pinnulæ. (3) One of the sucker-arms of a Cephalopod. (4) One of the oral tentacles of a rhizostomous Jelly-fish.

Brachycephalic. Head whose cranial dimensions are in the ratio of 8:7 length to the breadth. Such skulls are known as short. The Scandinavian races have predominatingly short heads. See Man.

Brachycera. Sub-order of *Diptera*, including true Flies. The body is usually stout; the short antennæ end in a ringed joint. Wings are generally present. The larvæ are maggots, with hooked jaws, and are generally movable as pupæ (*pupa obtecta*). They are partly parasitic, but generally live in decaying matter. They divide into two tribes, *Muscaria* and *Tanystomata*.

Brachyodont Dentition. That in which the molars have short, low crowns, as in *Cervidæ*.

Brachypleural Type. Of Trilobites. They have the anterior pleuræ, of the same relative length. Distinguished from macropleural type.

Brachypodous. In Botany and Zoölogy, short-stalked organs or organisms.

Brachyura (Crabs). *Decapoda* characterized by their broad cephalothorax and short abdomen (destitute of a caudal fin), which is narrow and pointed in the male, with one or two pairs of appendages; in the female, it is broad, and bears four pairs of abdominal appendages. Many Crabs live on land, some climb trees, but all breathe by gills kept moist with water.

Bracing. Members of a truss connecting the upper and lower chords, some being in tension and some in compression. The most economic arrangement of a truss is when the weight of the bracing approximately equals the weight of the chords.

Bracken. Fern, *Pteris aquilina*. A species of almost world-wide distribution, known also as Brake.

Bracket. In architecture, a projecting member supporting a weight; commonly applied to woodwork, the like member in masonry being called a corbel.

Bract. Any leaf which subtends a flower or flower-cluster; generally smaller than the ordinary foliage leaves, and often different in form.

Bractlet. Reduced leaves occurring on the pedicels of flowers.

Bracton (Bratton or Bretton), Henry de, d. ab. 1268. Justice in oyer and of assize. *De Legibus Angliæ et Consuetudinibus*, ab. 1258; pub. 1569.

Braddock's Defeat. July 13, 1755, Gen. Edward Braddock, with 26 officers and 714 privates, was killed in an ambuscade at Fort Du Quesne, near the site of Pittsburg, Pa.

Braddon, Mary E. See Maxwell, Mrs.

Bradford. Borough of Yorkshire, Eng., on the Aire, noted for its woolen manufactures. Pop., 1891, 216,361.

Bradford. City of McKean co., Pa., in the oil region. Pop., 1890, 10,514.

Bradford, William, 1589–1657. Second gov. of Plymouth Colony 1621, and mostly till his death. His *Hist.* was pub. 1856.

Bradlaugh, Charles, 1833–1891. English democrat, M.P. 1885; elected 1880; thrice rejected for refusal to take the oath.

Bradley, Edward ("Cuthbert Bede"), 1827–1889. English humorist. *Verdant Green*, 1853–57.

Bradley, George Granville, D.D., LL.D., b. 1821. Dean of Westminster 1881.

Bradley, James, D.D., F.R.S., 1693–1762. Prof. astronomy at Oxford 1721; director of the Greenwich Observatory 1742–61; discoverer of aberration of light and of nutation. His numerous observations, which possess a high degree of accuracy, have formed the basis for solving many of the problems of modern astronomy.

Bradley, Joseph P., LL.D., 1813–1892. Associate Justice of U. S. Sup. Court 1870.

Bradstreet, Mrs. Anne (Dudley), 1612–1672. Anglo-American poet. *Tenth Muse*, 1650.—Her husband, Simon, 1603–1697, was judge at Salem, Mass., 1630, and gov. of Mass. 1679–86 and 1689–92.

Bradwardine, Thomas, 1290–1349. Abp. of Canterbury 1349. He wrote against the Pelagian doctrine.

Brady, Nicholas, D.D., 1659–1726. Author, with N. Tate, of the *New Version* of the Psalms, 1696, long used; tr. *Æneid*, 1726.

Bradypodidæ (Sloths). Family of *Edentata*, sometimes treated as a separate order, called *Tardigrada*. They are S.

American hairy mammals, without incisor teeth, with short rounded face, feet adapted to clinging to the under side of branches of trees, being furnished with long hooked claws, and the palm and sole bent so as to be incapable of application to the ground, upon which they make awkward progress; two or

Bradypus tridactylus.

three toes, inclosed in a common skin, 23 pairs of ribs (the greatest number known in any mammal), and in some more than seven neck vertebræ. Fossil Sloths of gigantic size, like *Megatherium*, occur in S. America.

Brag. English game of cards, so called because each player endeavors to make the others believe his hand better than it is.

Braganza, HOUSE OF. Family of Portugal and Brazil; founded by Alphonso, son of John I., 1422, and called to the throne by the revolution of 1640.

Brage, or BRAGI. Son of Odin, god of poetry and eloquence in the Scandinavian mythology.

Bragg, BRAXTON, 1817–1876. Confederate general, serving chiefly in the West. He defeated Rosecrans at Chickamauga Sept 20, 1863.

Braham, JOHN, 1774–1856. English singer and composer, of Jewish parentage; long one of the finest tenors in England.

Brahe, TYCHO, 1546–1601. Danish astronomer, author of a long series of observations of unusual accuracy for that day. His theory of the solar system, proposed as a rival to that of Copernicus, never met with much favor. He d. at Prague.

Brahma. Creator god of Hindu mythology. According

Brahma, from Benares.

to the legends, both Sivaite and Vishnuite, he was born of a golden egg, laid upon the breast of the waters of Chaos by the "Being who existed before himself." He begat a daughter, Sarasvatī, "the word," and by incest with her gave birth to human kind. His role of creator accomplished, he became a secondary being, and no longer mixed with the affairs of the world, which he abandoned to the direction of the other gods. His name is invoked in prayers, but he has no particular worship, unless it may be that of Pushkara, near Ajmir.

Brahmagupta, ab. 598–ab. 660. Hindu mathematician, writer on Arithmetic, Algebra, Geometry and Trigonometry, making considerable advance beyond Aryabhatta.

Brahmanism. Second of the great religions of India. A modification of Vedism, it developed progressively, separating itself more and more from the primitive religion, until it had little in common except the Vedas, which it retained as the basis of its belief. It is characterized by the institution of a clergy and the division of the people into castes, the priests or Brahmans ranking first. Ab. 400 or 300 B.C., a reform or renovation of the belief was brought about by the rapid extension of Buddhism. In this modification the claims of the priests were still further exaggerated, and many concessions made to popular superstitions. The two rival trinities of Siva and Vishnu were fused into one, the Trimurti, in which was joined Brahma, the principal personage of both, and Brahma, Vishnu, and Siva became the symbol of the new faith. There are 20 sects of Vishnu and 9 of Siva, and the religion is professed by over 200,000,000 Hindoos.

Brahmapootra. River of s. Asia, rising in Thibet. With its branches it drains the e. part of the slopes of the Himalaya, most of their n. slopes, and much of the plateau of Thibet. It joins the Ganges within its delta. Length 1,800 m., drainage area 361,200. sq. m.

Brahmins. Highest priestly caste of the Hindus, declared to have proceeded from the mouth of Brahma; exercising an iron rule, now gradually relaxing, over the other castes. Buddhism was largely a reaction from their oppression.

Brahmo Somaj. Hindu society, formed 1830 by Rammo hun Roy, revived 1859 by Keshub Chunder Sin; monotheistic, renouncing caste, of pure morals and high aspirations, and closely approaching Christianity; not numerous, but of considerable influence in India.

Brahms, JOHANNES, b. 1833. Most eminent of living German composers. His fame dates from 1853, when he visited Schumann in Düsseldorf. Since 1861 he has lived in Vienna. He is an exemplar of classic thought and manner, and in his adherence to form stands as the opponent of the school stimulated by Liszt and Wagner. His principal works are four symphonies, the *German Requiem*, *Triumphlied*, and concertos for the violin and piano.

Brails. Ropes passing through pulleys on the mizzenmast and yard used to truss the sail up to the mast. Also, ropes used to haul up the bottoms, lower corners and skirts of the other great sails.

Brain. Largest and most important division of the nervous system; made up of the cerebellum, cerebrum, pons varolii, and medulla oblongata, all situated in the skull, which reaches

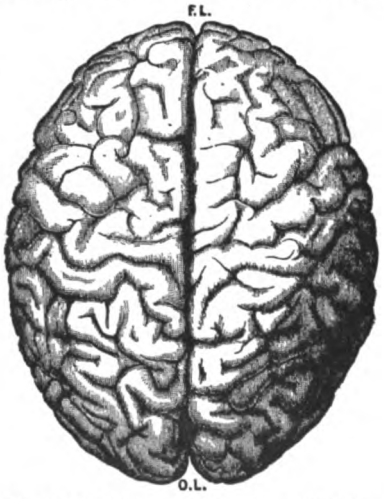


Fig. 1.—Cerebrum—upper surface (Quain):
To show, firstly, division into two nearly equal hemispheres by the great median fissure; secondly, general appearance and apparent irregularity of arrangement of the convolutions and fissures; F.L., frontal lobe; O.L., occipital lobe.

its highest stage of development in man. In males and females the average weights are respectively ab. 50 and 44 oz., and its proportional weight to that of the body is ab. 1 to 45 in both sexes. The heaviest brain on record was that of Lord Byron,

which reached 79 oz., while those of several men distinguished for their abilities were below 50, and those of many undistinguished persons have exceeded 60, thus showing that the actual weight is no accurate standard of intellectual development. It is certain, however, that low weight corresponds as a rule with deficiency of the mental powers, and that the average weight among savage races is less than among the civilized. There is no doubt that it is most intimately connected with the manifestations of the intelligence, that all voluntary movements are controlled by and are dependent upon

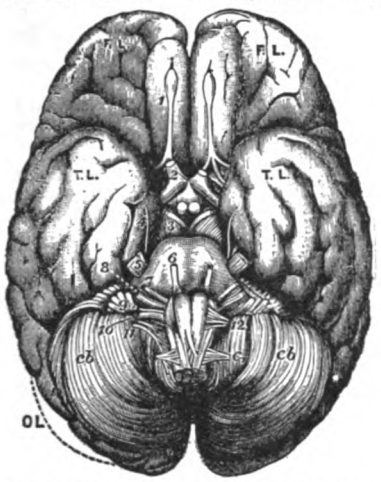


Fig. 2.—Under Surface, or Base of Brain:

F.L., T.L., O.L., frontal, temporal, and occipital lobes of the cerebrum; *cb, cb*, cerebellum, the medulla oblongata lying between its two lobes. *Cranial Nerves.* 1, olfactory lobe (the nerve of smell); 2, optic nerve (nerve of sight); 3, third or oculo-motor nerve, motor nerve to most of the muscles of the eye; 4, fourth or trochlear nerve, motor nerve to the superior oblique muscle of the eye; 5, fifth, trigeminus, or trifacial, sensory and motor, the large root sensory to the face and eyes, &c.; the small root, motor to muscles of mastication; 6, sixth or abducens nerve, to external rectus muscle of eye, turns eyeball outward; 7, seventh or facial, motor to muscles of expression; 8, eighth or auditory nerve, sensory for hearing (cochlea) and for equilibration (semicircular canals); 9, glosso-pharyngeal, sensory nerve of taste, and motor to some of the muscles of deglutition; 10, pneumogastric, sensory and motor to larynx, lung, heart, and stomach; 11, spinal accessory, motor to muscles of heart (inhibitory) and sterno-mastoid and trapezius; 12, hypoglossal, motor to all the muscles of the tongue; *cl*, first cervical spinal nerve.

it; and that there are localized centers which control these movements, perceive sensations, and are connected with the performance of all mental acts. Yet scores of cases have occurred in which large portions of it have been destroyed by injury or disease without any perceptible effects upon its functions, but loss of some of these usually follow such injury. It is probable that there is some close relation between the number and complexity of its convolutions and the amount of intellectual development. See CEREBELLUM, CEREBRUM, MEDULLA and PONS VAROLII.

Brainard, JOHN GARDINER CALKINS, 1796–1828. American poet; ed. *Conn. Mirror.*

Brainerd, DAVID, 1718–1747. Missionary to the Indians in Pa. and N. J.—His brother, JOHN, 1720–1781, continued his work.

Brain Fever. Properly restricted to the condition in which there is actual inflammation of the brain substance, an extremely rare disease, if indeed it ever exists. Popularly, the term includes meningitis or any fever in which headache and delirium are prominent symptoms.

Brake (BRACKEN-FERN). World-wide and well-known fern, *Pteris aquilina.* See BRACKEN.

Brake. Apparatus for retarding or stopping the motion of a revolving wheel. A railway brake is usually suspended by a trussed beam, and the portion in contact with the wheel is called the shoe. In the Westinghouse brake system the shoe is pressed against the wheel by springs, and moved away by the action of compressed air against a piston; thus the brake acts automatically in case of an accident. See PRONY BRAKE.

Brake, AIR, or ATMOSPHERIC. Device for putting on or off, by the use of compressed air, the brakes which retard the motion of a railway train. An air-pump on the locomotive compresses air into a reservoir (usually under the foot-plate), and from there a pipe may carry the air to the cars of the train and to cylinders under each car. This pipe is made continuous by rubber hose connections at each end of each car. The engine-driver by opening a valve in the engine-cab can allow pressure from the main reservoir to pass into the pipe, and so to the brake-cylinders of the cars, and by acting on the movable pistons in these cylinders the air-pressure applies the brakes. This is now known as the "straight-air" plan, and was the early form of the Westinghouse brake. It was not automatic in case of accident when any car was disconnected from the engine reservoir.

Brake, AUTOMATIC. So designed that, in case of accident from breakage of connection with the engine or the rest of the train, the brakes on any car shall at once be applied. This condition is particularly necessary for safety when a train parts on a grade. See BRAKE, WESTINGHOUSE.

Brake, CONTINUOUS. Device by which the operation of applying the brakes of a railway train shall be effected on all the cars at once and equally, by the act of one man, who is usually the engineer. Where the several cars of a train had hand-brakes only the application was slow, was done only on signal from the engineer who saw the danger, and was unequal, the unbraked cars thumping and tugging at the retarded ones. The various types of the continuous brakes have depended on springs, chain, water pressure, air-pressure, and electricity to secure continuity through the train.

Brake, FRICTION, or PRONY. Dynamometer for measuring the power given off by a motor through a revolving shaft. A brake-shoe or band is pressed against the circumference of a shaft or pulley by means of bolts enveloping the pulley, and the number of pounds necessary to hold that shoe or band from moving is the amount of friction on that brake. The product of that number of pounds into the number of feet per minute through which the point of application of the weighed load would have moved had it been free at that speed of revolution, gives the compound unit of foot-pounds per minute. The horse-power is derived by dividing the measured foot-pounds in one minute by 33,000, which is the number of foot-pounds in one horse-power.

Brake Tests. Those made by Captain Galton show that coefficient of friction between the shoe and the wheel decreases with the speed. A formula showing the rate of decrease is

$$f = \frac{0.326}{1+0.03532v}$$

in which f is the coefficient of friction and v is the speed of the train in miles per hour.

Brake, VACUUM. Continuous train-brake for railway service, in which the power applied upon the brake-beams is due to the pressure of the atmosphere on one side of a flexible diaphragm or collapsing cylinder, from the other side of which the air has been exhausted. The exhaust side of all the diaphragms of the cars of a train is connected to a pipe under the cars, coupled by flexible hose to an ejector on the engine. The engineer, by turning on steam in a jet apparatus, induces by the velocity of the steam a flow of air out through the brake-pipes, and creates a vacuum therein which puts on the brakes. By breaking the vacuum by opening a valve to the air the brakes are released. In its commoner form this brake is not automatic. It is made so by such an alteration as shall cause the brakes to be kept off by the maintenance of the vacuum in special car reservoirs. The brakes are applied in this system whenever a hose coupling parts or a car becomes accidentally detached, and the brake becomes self-acting.

Brake, WESTINGHOUSE. Each car carries a reservoir charged with compressed air from the reservoir on the engine through the train-pipe. The engineer's valve in the cab can let the pressure at will upon the pipe, and the pressure will act upon a piston in what is called the automatic valve under the car, so adjusting the position of the latter as to allow the air to enter the car reservoir. When the engineer's valve is so turned as to let off pressure in the brake-pipe the excess of pressure is reversed in the automatic valve, the valve moves so as to turn air from the car reservoir into the brake-cylinder,

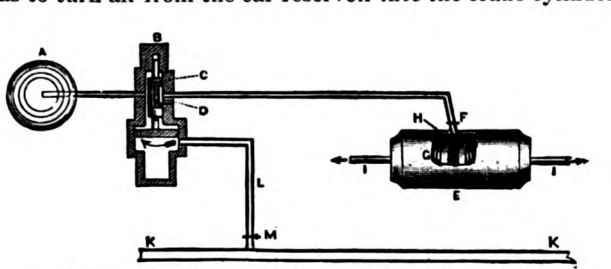


Diagram of Westinghouse Automatic Brake, Showing Arrangement for One Carriage:

A, reservoir; B, triple valve; C, slide valve; D, exhaust; E, brake-cylinder; F, release valve; G, spring; H, pistons; I, I, communication to brake-lever; K, main pipe extending all along the train; L, branch pipe; M, cock.

and the brakes are applied from the car itself. Pressure in the brake-pipe again shifts the automatic valve, and the air in the brake-cylinder is expelled through an exhaust passage into the

open air by a spring behind the brake-piston. Since the brakes are applied by the release of pressure, the rupture of the brake-pipe by the parting of the train will at once apply the brakes. The automatic brake can be changed into the "straight-air" brake by shutting off the automatic-valve, and the car reservoir by means of a four-way cock in the pipe.

Bramah Press. HYDRAULIC PRESS (q.v.). So called because first successfully constructed by Joseph Bramah 1749–1814.

Bramante, or BRAMANTE LAZZARI, 1444–1514. Architect of the Italian Renaissance, who designed for Pope Alexander VI. the Palace of the Cancellaria in Rome, for Julius II. two galleries connecting the palace and the Belvedere and inclosing a court. He was the original architect of St. Peter's, and the four great piers and their arches were built under his supervision. Although he died before the dome was completed, the domed churches built from his designs are among the finest and most celebrated monuments of the Renaissance. Among them are the four apsed churches at Lodi and the dome of Santa Maria dell Grazie at Milan.

Bramble. Prickly shrubs of genus *Rubus*. More commonly known in America as Blackberry.

Bramhall, JOHN, D.D., 1594–1663. Bp. of Derry 1634; Abp. of Armagh 1661. He wrote against Hobbes 1655–58.

Bramham Moor. In Yorkshire, scene of the defeat of the Earl of Northumberland and other revolted nobles by Sir Thomas Rokeby, Feb. 19, 1408.

Bramwell, SIR FREDERICK JOSEPH, D.C.L., F.R.S., b. 1818. English civil engineer; knighted 1881 for his services in promoting engineering education; baronet 1889.

Bran. Seed-coats of the grain with whatever may adhere to them when separated by milling. It is a by-product of the milling process, and furnishes a valuable class of cattle foods, the most important of which, wheat bran, is usually meant. Brans are almost always richer in protein matter than the grains from which they were made. They lack somewhat in digestibility but are nearly always palatable.

Brancacci Chapel. In the ch. of Santa Carmine, Florence, containing famous frescoes by MASACCIO (q.v.).

Branch of a Curve. Portion limited by specific points of structure or character.

Branches. Divisions of the stem of a plant; the ultimate ones are termed branchlets.

Branchiæ. See GILLS.

Branchial Apertures, or CLEFTS. Slits or openings between the gills of fishes and the embryos of other Vertebrates. Five pairs in Teleosts are usual; in Myzodonts there are seven; in embryos four.

Branchial Arches, or BARS. Bones or cartilages that support the gills in Fishes.

Branchial Basket. System of cartilages that supports the pharynx of a Lamprey. See BRANCHIAL SAC.

Branchial Cavity, or CHAMBER. Beneath the branchiostegites of a Lobster, containing the gills.

Branchial Coil. Spiral tube formed on the roof of the pharynx in Menhaden.

Branchial Duct. Canal in Lampreys, leading from the throat to the gills, and thence to the exterior.

Branchial Folds. Integument or epithelium covering a branchial arch, from which, in aquatic breathing Vertebrates, the gill filaments are formed as buds. Sometimes the filaments are held together by a branchial lamella, and in Lampreys and Sharks they are formed in peculiar branchial pouche.

Branchial Hearts. Pulsating dilatations on the blood-vessels in a Cephalopod, situated at the base of the branchia, and serving to drive the blood through them.

Branchial Lamella, or BRANCHIAL PLATE. See BRANCHIAL FOLDS.

Branchial Pores. Pair of openings placed ventrally in the Hagfish (*Myxine*), each of which receives a duct which unites all the branchial ducts of its side.

Branchial Pouches. See BRANCHIAL FOLDS.

Branchial Sac, or BRANCHIAL BASKET. That part of a Tunicate's œsophagus which is pierced by numerous apertures for the passage of water for respiratory purposes.

Branchial Sense Organ. Group of sensory cells situated at the dorsal end of a branchial cleft in Vertebrates. It is connected with a special ganglion and a dorsal branch of each segmental nerve of the vagus, etc. It is believed that the nasal and auditory organs have developed from similar sensory patches in corresponding anterior visceral clefts.

Branchial Septum. Gill stretching from the dorsal to the ventral side of the branchial sac of some Tunicates.

Branchial Stigmata. Pores through the walls of the branchial sac of Tunicates.

Branchial Tentacles. Filaments, sometimes greatly branched, borne on the head of certain Annelid worms, and serving respiratory functions.

Branchial Tufts. Group of branchial tentacles.

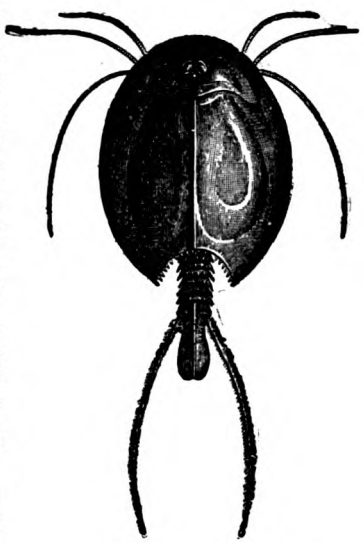
Branchiata. (1) Group of Vertebrates, including the Fishes and Amphibia; same as *Ichthyopsida*. (2) Group of Molluscs. See BRANCHIFERA. (3) Group of Arthropods, the *Crustacea*. (4) Group of worms. See POLYCHÆTA.

Branchifera, BRANCHOGASTROPODA, or BRANCHIATA. Includes the orders of Gastropods that have branchiæ; viz., the Prosobranchs and the Opisthobranchs.

Branchiobdellidæ. Leeches with two jaws, no proboscis, with bilobed cephalic lobe, without eyes, and with a sucker at the posterior end of body.

Branchio-cardiac Groove. On the back of the lobster's cephalothorax, marking out the heart area.

Branchiopoda. Phyllopods with 10 to 30 or more foliaceous feet. Most live in stagnant fresh water, but *Artemia* lives in brine pools. Here also belong *Branchipus* and *Apus*. Eggs are carried in special internal or external brood-pouches. A simple median eye, and often also a pair of compound eyes, are present. In a broad sense the term has been used to cover the *Cladocera* and *Phyllopeda*, and even all Crustaceans, together with the *Gigantostraca*.



Branchiopoda (*Apus.*)

Branchiostegal Rays. Curved, slender bones that support lower and back edge of operculum, or gill cover, of fishes. United by branchiostegal membrane.

Branchiostegite. Side piece of the cephalothorax of Lobster or Crayfish; it incloses the gill cavity or branchial chamber.

Branchiostoma. See LEPTOCARDII.

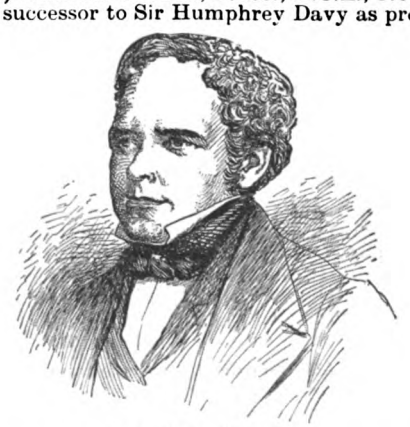
Branchiotroch. Post-oral part of a trochosphere.

Branchipus. Phyllopod found in fresh-water pools; also called Fairy Shrimp. See PHYLLOPODA.

Branchiura. Group of Copepods (Carp-lice), including forms which possess, besides median simple eye, a pair of compound eyes, four pairs of swimming feet, and abdomen ends, in two leaf-like lobes.

Branchogastropoda. See BRANCHIFERA.

Brande, WILLIAM THOMAS, F.R.S., D.C.L., 1788–1866. Assistant and successor to Sir Humphrey Davy as prof. of chemistry to the Royal Inst. 1816–50. Ed. Brande's Dictionary. *Outline of Geology*, 1817; *Elements of Chemistry*, 1831; *Dict. of Materia Medica*, 1839.



Wm. Thos. Brande.

Brandenburg. German province, occupied by Suevi, afterward by Slavs; conquered by Charlemagne and by Henry I. 928. It became a Mark 1142, Albert the Bear being first Markgraf; Frederic of Nürnberg was first elector 1417. Johann

Sigismund became duke of Prussia 1618; Frederic III. became king of Prussia 1701. It is now a province of Prussia; area 15,380 sq. m.; pop., 1890, 2,542,401, without Berlin.

Brandes, GEORG MORRIS COHEN, b. 1842. Danish literary historian and critic of great influence. *Danish Poets*, 1877; *Modern Authors*, 1882.—His brother, CARL EDUARD COHEN, b. 1847, is a dramatist and critic.

Brandes, HEINRICH WILHELM, 1777–1834. Prof. physics at Leipsic; first student of synchronous daily weather maps and of storms and weather in the modern manner. He discovered that storm-winds circulate about an area of low barometric pressure. *Memoir on Atmospheric Waves; Equilibrium of Fluids and Solids in Motion.*

Branding. Ancient punishment for slaves and convicts. Galley-slaves could be branded in France till 1832. In England vagabonds and brawlers might be burned in the cheek or forehead as late as 1636.

Brandis, CHRISTIAN AUGUST, 1790–1867. Prof. at Bonn 1821; historian of Greek philosophy 1835–66.

Brandy. An alcoholic liquor made by distilling the fermented juice of fruits, especially that from grapes. The best brandy is made in the Cognac district of France, embracing ab. 60 sq. m. It is made by the farmers, who sell their product to the merchants. By these the brandies are blended. White wines furnish finer quality than the red. The wines are also sold to distillers. The color is imparted to the brandy by the cask, or burnt sugar is added for this purpose.

The ripe grapes are crushed in a grape mill and the remaining juice is expressed by powerful pressure, three pressings of two hours each and a final pressing overnight. The refuse from the press is sprinkled with water and again pressed. This last product is used for inferior brandy. The juice from the mill and the four pressings are fermented in casks or vats, under the influence of ferment of the grape, at 12° C. to 18° C. for from 2 to 3 months. The resulting wine is then distilled in a simple still heated by steam or on a water bath, which are regarded to be less liable to injure the flavor of the brandy than other forms of still. In the larger establishments Derosne's continuous still is much used. 100 to 150 gals. of brandy are obtained from 1,000 gals. of wine.

Brandy contains from 50 to 54 per cent of alcohol, with small quantities of acetic acid, acetic ether, œnanthic ether and coloring matter, with tannic acid derived from the cask. The aromatic odor is due to these ethers, together with ethyl pelargonate formed during the fermentation of the grape juice.

Apple and peach brandy are made by distilling the fermented juice of the respective fruits. Grape brandy is chiefly made in France, Spain, Portugal and California. The product of France has formerly reached 22,000,000 gals., but the disease of the vines has diminished this.

A large amount of imitation brandy is prepared from alcohol with addition of various essential oils and chemicals.

In U. S. in 1893, the production of brandy from grapes, apples and peaches was 2,358,548 gals., the importations were 326,303 gals., and the consumption 1,687,541 gals. The exportations were 317,724 gals. in 1894.

Brandy Station. In Culpeper co., Va.; scene of engagements Aug. 20, 1862, June 9, Sept. 13, and Oct. 11, 1863.

Brandywine Creek. In Pa. and Del. At the battle here, Sept. 11, 1777, Washington was defeated with loss of 1,200, by the British under Howe, who lost less than 600. Result, Philadelphia fell into the hands of the victors.

Brant, JOSEPH, 1742–1807. Mohawk chief, ally of the British during the Revolution.

Brant, SEBASTIAN, 1458–1521. German satirist. His *Narrenschiff* (Ship of Fools), 1494, Latin tr. 1497, Eng. 1508, was an epoch-making poem.

Brant-Geese. *Branta bernicla.* Black Sea-Geese. True Brants and Bernicle-Geese are different species, the latter being larger, capable of breeding in captivity, and mostly confined to Arctic regions of Old World, while Brant breeds also in Greenland. See ANSER.

Brantôme, PIERRE DE BOURDEILLES, SEIGNEUR DE, ab. 1530–1614. French biographer. *Illustrious Men and Great Captains.*

Brard, CYPRIEN PROSPER, 1786–1838. French mineralogist. *Minéralogie Appliquée aux Arts*, 3 vols., 1821; *Nouveaux Éléments de Mineralogie*, 1824.

Brasidas, d. 422 B.C. Spartan general, prominent in early part of Peloponnesian war.

Brasiline. $C_{16}H_{14}O_5$. Red dye-stuff present in red or Brazil-wood; colorless needles, of unknown constitution.

Brass. Mixture of copper and zinc in various proportions, from 66 copper, 34 zinc, for castings, to 88 copper, 12 zinc, for buttons. Cast brass weighs ab. 505 and rolled brass ab. 525 lbs. per cubic ft. Brass wire has a tensile strength of 50,000 lbs. per sq. in. See COPPER, METALLURGY OF.

Brassage. Sum or percentage paid for coining money. See SEIGNIORAGE.

Brassey, THOMAS, 1805–1870. English railway contractor.—His son, THOMAS, b. 1836, K.C.B. 1880, peerage 1886, Lord of Admiralty 1880. *British Navy*, 5 vols., 1882–83.

Brattice. Partition in a mining shaft or level, serving to keep the air currents on opposite sides distinct from each other.

Braun, ALEXANDER, 1805–1877. German botanist; prof. Berlin. *Verjüngung in der Natur*, 1851; *Parthenogenesis bei Pflanzen*, 1857.

Brauner, JOHN C., b. 1840. American geologist; prof. geology Leland Stanford Univ., Cal. Formerly on Geol. Survey of Pa., then on survey of Brazil, and State Geol. of Ark. *Reports on the Geology of Arkansas.*

Bravais, AUGUSTE, 1811–1863. Prof. of physics at Polytechnic School, Paris. Explorer of Algiers, Spitzbergen, Norway, and Switzerland. Report of the *Expedition du Nord.* Wrote on meteorology, temperature and capillarity.

Brawl. Statutory offense, consisting in a noisy or tumultuous disturbance of the peace. In some statutes is synonymous with railing; in others, with tumult; in still others it is riotous, violent or indecent behavior in a church.

Brazil. Largest country of S. America, rudely triangular in form, with an area of 3,210,000 sq. m. It lies e. of the Andes; most of it is a low plain, covered with tropical forests, and drained by the Amazon and its tributaries. S. of this region the land rises to a plateau-like divide, upon the s. slopes of which head branches of the Rio de la Plata. The e. part is somewhat broken by a series of mountain and hill ranges, trending parallel to the Atlantic coast, 5,000 to 6,000 ft. in height. Its rivers are the Amazon, the largest in the world, the Paranahiba, the San Francisco, and the upper courses of the Parana and Paraguay. The climate of the Amazon basin is tropic in temperature, with a heavy rainfall. Further s. it becomes more temperate, and in the s. interior semi-arid. The chief products of the country are coffee, sugar, cotton, and tropic fruits, diamonds are found in some localities. Coal is mined to some extent in the s., and gold is found in placers in the e. mountains. There are more than 6,000 m. of railroad. The government was a hereditary monarchy, limited by a legislature. The capital is Rio Janeiro. Other important cities are Pernambuco and Bahia. B. was discovered by Pinzen 1499, and was subject to Portugal till 1822. On Napoleon's overthrow of the House of Braganza, John VI. fled with his court to B. 1808. On his return in 1821 he left his son, Pedro, as regent. Independence was declared 1822, and Pedro became emperor. In 1823 he succeeded by right to the Portuguese throne, but resigned it to his daughter, Donna Maria. He abdicated 1831 in favor of his son, Dom Pedro II., who reigned through a regency until 1841, and in person till 1889, when a republic displaced the empire. Slavery had been abolished 1888; federal constitution was adopted Feb. 24, 1891; the first president, Fonseca, was deposed in Nov. 1891, and succeeded by Peixoto. An insurrection of the navy was brought to an end March 1894. Pop. ab. 16,500,000, In 1890 the imports amounted to $71,500,000, and the exports to $87.400,000.

Brazil, ISLAND OF. Imaginary island in the Atlantic, found in maps of the 15th century as one of the Azores; on later charts it appears ab. 100 m. w. of Ireland. "Brazil Rock" is found in a chart of 1853, but has now disappeared.

Brazilian Pebble. Trade name for a clear variety of rock-crystal.

Brazil-Nut. *Bertholetia excelsa.* Large tree of Myrtle family, bearing well-known three-cornered seeds in large, globular, woody fruits; native of n. S. America. The seeds are an important article of commerce.

Brazil-Wood. *Cæsalpinia echinata.* Small tree of Bean family, native of Brazil. The hard wood is used for cabinet work.

Brazos. River of Texas. It heads in the edge of the Staked Plains, and flows s. e. across the State. Length 900 m., drainage area 59,646 sq. m.

Breach of Contract. Refusal to fulfill the conditions entered into by a deliberate promise.

Breach of Promise. Refusal to perform a contract to marry, or repudiation of such contract. It will not sustain an action for specific performance of the contract, but for damages only, which are to be determined generally by the jury, who may impose vindictive or punitory damages.

Breach of the Peace. Any conduct that violates public order or decorum, or tends directly to excite others to its violation.

Bread. Is generally made by mixing flour of grain with water, adding yeast, allowing it to ferment, and baking it. The action of the yeast causes the formation of carbon dioxide at innumerable points throughout the entire mass of dough, in small cells. Under the influence of heat the gas is expanded and escapes, thus making the bread "light." By the use of YEAST POWDERS (q.v.), the same gas is generated without fermentation by the decomposition of bicarbonates of ammonium and sodium. Unleavened bread is made by mixing flour and water without the addition of yeast or any other agent that will cause fermentation to take place.

Bread and Cheese War. In Holland, latter part of 15th century; occasioned by famine.

Breadfruit. *Artocarpus incisa.* Small tree of natural family *Moraceæ*, native of S. Pacific Islands, bearing a mass of fruits ab. a foot long and shaped like a melon; an important article of food. In w. Africa the name is applied to *Treculia Africana*, a related tree.

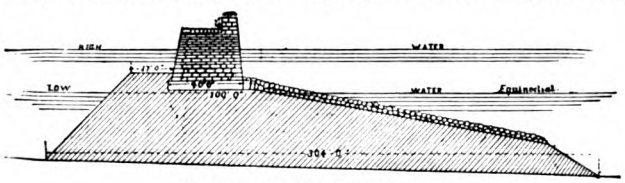
Bread, NATIVE. Large Australian fungus, *Mylitta australis*, said to be eaten by natives.

Bread-Nut. *Brosimum Alicastrum.* W. Indian tree related to the Bread-fruit.

Breakbone Fever. Also known as Dengue and Dandy fever. Often prevalent as an epidemic in warm climates; almost never fatal, except in those previously in bad health; characterized by almost unbearable pains in the bones and muscles. It is self-limited, is amenable to no specific treatment, and lasts for several days: the full strength is very slow to return after its subsidence.

Breaker. (1) Machine with one or more movable jaws for crushing rock. (2) Building and machinery used in preparing anthracite coal for market, the object being to supply coal of different sizes, according to the demand and the way in which it is to be used.

Breakwater. Dike or embankment made of stone to protect entrance to a harbor; usually made of rip-rap stone of large size, but sometimes of regular masonry or concrete. That at Plymouth, England, is of rip-rap, 5,100 ft. long in 30 ft.



Cherbourg Breakwater. France.

depth of water, and cost nearly $8,000,000. The one at Dover is of regular masonry in 45 ft. of water, and its cost was over $2,000 per linear foot. That at the entrance to Delaware Bay, begun 1822 and not yet completed, has cost over $3,000,000; it consists of an ice-breaker 1,500 ft. long and the breakwater proper, 3,600 ft. long.

Bream. To burn off the accumulations of filth from the bottom of a vessel.

Breast. In mining, surface of the rock or ore at the extremity of a drift, chamber, or other working-place.

Breast-Summer. Beam placed over several doors or windows and supporting the wall above it.

Breast-Wall. Masonry wall supporting a bank of sloping earth in a cutting; sometimes a low wall, breast-high.

Breast-Wheel. A form of water-wheel in which the water was laid on at or below the horizontal diameter of the wheel, and passed down below the axis and carried the wheel around as it flowed in a curved channel shaped closely to the buckets. It was applied where the head of water was small, and yet a large diameter of wheel was desirable. The buckets may be radial, but are better curved. The ordinary efficiency is 40 to 60 per cent, and the most carefully constructed breast-wheels do not have an efficiency of over 75 per cent.

Brébeuf, JEAN DE, 1593–1649. French Jesuit, missionary to Canada 1625; murdered by the Iroquois.

Breccia. Mass of angular fragment of rock, cemented together by natural agencies.

Breckinridge, JOHN, D.D., 1797–1841. Prof. Princeton Theol. Sem. 1836–38. He had a controversy with Abp. Hughes 1836.—His brother, ROBERT JEFFERSON, D.D., LL.D., 1800–1871, prof. Danville Theol. Sem., Ky., 1853–69, was an eminent loyalist during the war. *Knowledge of God*, 1857–59. Both were leading Presbyterians.

Breckinridge, JOHN CABELL, 1821–1875. M. C. 1851–55. Vice-Pres. U. S. 1857–61; candidate for Pres. 1860; elected to the Senate 1861; Confederate gen. 1861–65, and Sec. of War Jan. 1865,

Bredahl, CHRISTIAN HVID, 1784–1860. Danish dramatist.

Bredero, GERBRAND ADRIAENSZ, 1585–1618. Dutch dramatist and poet.

Brederode, HENDRIK VAN, COUNT, 1531–1568. Dutch patriot.

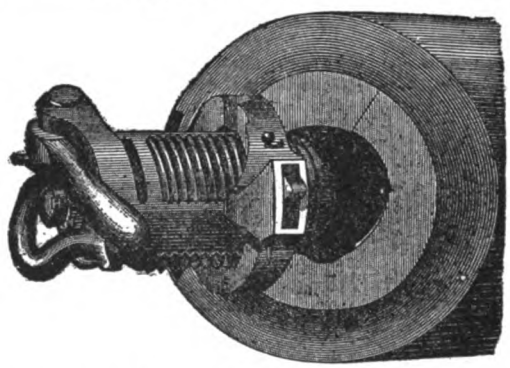
Breech-Loading Firearms. The use of breech-loaders goes back to the 16th century, and probably is as old as the muzzle-loader. It is made with a movable breech, to admit of the charge being inserted at the breech. The earliest muskets were made in this manner, it being doubtless abandoned from the difficulty of closing the breech. This system has only been carried out in the last 40 years. The advantages claimed over the muzzle-loaders are—quickness in firing, being about 5 times as fast, and faster still when a magazine is combined with the rifle, as in repeating rifles; more easily and readily cleaned;

German Mauser Rifle.

rifled more accurately; saving in metal and powder, and accurate adjustment of the cartridge to the caliber of the gun, thus increasing the range and accuracy of the weapon. In the first ones used the cartridge was made of paper, which burned up when the gun was discharged, but now of metal, which is ejected when the breech is opened. Its efficacy was shown especially in the late Civil War and in the Franco-Prussian War. Among the best-known rifles are the Chassepot, Lebel, Sharp, Snider, Enfeld, Spencer, Ward-Burton, Mauser, Remington, Martini-Henry, and Springfield; the latter being used by the U. S. troops.

Breech-Loading Ordnance. All modern ordnance is now loaded at the breech instead of at the muzzle. Devices are used which not only provide a closure of great strength, but check the gas without interfering with a high speed of operation.

The breech-mechanism is a combination of mechanical contrivances which close the breech, check the gas, and cover the firing apparatus. The principal devices now employed are the interrupted screw system, combined with the de Bange or cup gas-check and the horizontal wedge in combination with the



Elevation of Breech (open).

last. In the interrupted screw system the breech or movable block has its surface threading longitudinally divided or interrupted, while similar divisions are made in the breech thread for receiving the block. Locking devices are employed to prevent the blocks unscrewing on discharge. In the heavier ordnance a tray is hinged to the gun to support and guide the block while loading. In the wedge system the breech block moves horizontally (although a few vertical ones have been fitted) through a slot in the breech. The semi-cylindrical wedge is set up and locked by special devices. As it is more extensively used by Krupp than by any one else it is generally known as the Krupp wedge. The recoil of the gun is utilized in some devices in combination with springs for the automatic opening and closing of the breech.

Breed. Race or family of domestic animals which has been so selected naturally or artificially that its peculiar characters are uniformly transmitted from parent to offspring. Breeds of the same species are perfectly fertile when bred together. For breeds of domestic animals, see CATTLE, HORSES, SHEEP, etc.

Breeds and Breeding. The principles governing the production of breeds of plants or animals are included under the

three heads of HEREDITY, VARIATION, and SELECTION (q.v.). The breeder must have a clear idea of the form and purposes of the breed he is seeking to establish, and a keen eye to discern spontaneous individual variations. He can hasten the establishment of a breed by inbreeding, *i.e.*, pairing sire and daughter, etc., but must not push this too far, because most of the breeds thus established lack constitution. He can in a measure increase the effects of a cross by separating the close relatives that are to be paired and subjecting them to diverse environments for a considerable period before they are paired. In this way, if two breeders work for the same ends in different countries or localities, they do well to interchange their breeding animals. It is also considered that a variety is more readily established through using the male first and persisting until the same points are fixed in the daughter. This means that (1) males are more variable; (2) males are prepotent in transmitting their qualities to their daughters; (3) certain female characters really transmitted by the male, but latent in him, appear in the daughters, and are to be considered as really belonging to the strain which the male represents; *e.g.*, the tendency to give better milk may be transmitted through a bull. All that is needed is the knowledge that if the daughters of such a sire resemble him, have inherited his nature, they also are better cows. In other words, neither male nor female represents the entire characteristics of the race; both sexes are present in each animal, but one sex is latent. Again, it must be remembered that all the race characters do not appear in any pair, but that some are usually latent, and, further, that the ones that are developed are brought out during development by certain external conditions. In this way a new character may depend for its existence on some local or temporary cause perhaps connected with a peculiar environment; in which case a change of locality may destroy the variety, and the older characters alone will be developed. This is atavism or reversion. Such loose characters may, by long breeding, become so fixed that they will not revert; the old race characters were once just as superficially rooted. The last new acquirement is always the least stable and must be carefully nursed or cultivated until it has become well rooted.

Brehm, ALFRED EDMOND, 1829–1884. Director of the Zoölogical Garden at Hamburg 1863–67; founder of the Aquarium at Berlin 1867. *Thierleben*, 10 vols., 1863–68.

Brehon Law. Prevalent in Ireland till the conquest: "the creation of a class of professional lawyers, the Brehons, whose occupation became hereditary."

Breisach, or BRISACH. Fortified town of Alsace, on the Rhine; besieged by Duke Bernard, August 1638; capitulated Dec. 18, and dismantled 1641.

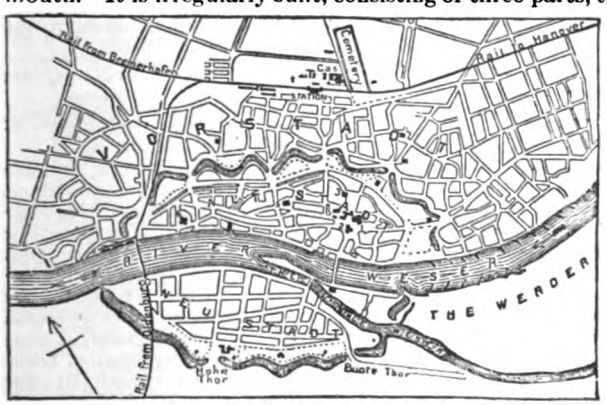
Breitenfeld. See LEIPZIG.

Breithaupt, JOHANN FRIEDRICH AUGUST, 1791–1873. German mineralogist; prof. Freiberg 1826–66. *Handbook of Mineralogy*, 1836; *Paragenesis of Minerals*, 1849.

Breitinger, JOHANN JAKOB, 1701–1774. Swiss critic.

Breitmann, HANS. See LELAND, CHAS. G.

Bremen. Free city of Germany, on the Weser, 50 m. from its mouth. It is irregularly built, consisting of three parts, the



Plan of Bremen.

1. Cathedral.
2. Exchange.
3. Museum.
4. Rathhaus.
5. St. Ansgarius.
6. St. Stephen.

old town and its suburbs on n. bank of the river, and the new town on s. bank. It is on navigable water and has a very large commerce. Pop., 1890, 124,887.

Bremer, FREDRIKA, 1801–1865. Swedish novelist, long popular in England and America. *Axel and Anna*, 1828; *Neighbors*, 1837, tr. 1842; *Home*, 1839; *Hertha*, 1856.

Brennus. Legendary chief of the Senones, who defeated the Romans at the Allia, took Rome 390 B.C., and received 1,000 pounds of gold as a ransom. (2) Leader of Gauls who invaded Macedonia and Greece 280 B.C.; defeated near Delphi, 279.

Brentano, CLEMENS, 1778–1842. German dramatist and novelist. *Ponce de Leon*, 1804.

Brentano, LUJO, b. 1844. German economist, prof. at Breslau, Strasburg, Vienna, Leipzig and Munich. He belongs to the group known as Socialists of the Chair, and has written much on guilds and labor.

Brenz, or BRENTIUS, JOHANN, 1499–1570. Swabian reformer; provost at Stuttgart 1552. *Catechism*, 1528; *Works*, 8 vols., 1576–90.

Brera. Picture gallery of Milan. It contains Raphael's *Sposalizio*, fine Mantegnas and Bellinis. Da Vinci's original drawing for the head of Christ in the *Last Supper*, and other important works.

Brescia. City of northern Italy, at foot of the Alps; noted for its manufacture of arms and cutlery. It was the ancient Brixia, an imperial city ab. 936, and after many vicissitudes was annexed to Sardinia 1859. Pop., 1890, 43,354.

Breslau. City of Prussia, on the Oder, at mouth of the Ohlau. It is irregularly built, consisting of an old and a new town. It has a university, founded 1702, libraries, museums, an observatory, and is an important manufacturing and commercial city, dating from ab. 1000. It was held by Poland, Bohemia, and Austria till 1741, and taken by the French 1807 and 1813. Pop., 1890, 335,186.

Breslau, PEACE OF, 1742. Silesia was ceded by Maria Theresa to Frederic the Great, who withdrew from the treaty of Nymphenburg.

Brest. Fortified seaport of w. France. It has an excellent harbor and is of commercial importance. Pop., 1891, 75,854.

Bretagne. See BRITTANY.

Brethren of the Common Life. Organized ab. 1375 by G. Groot in Holland; they spread to Germany and Italy, and in 1460 had 130 houses. They were of exemplary character, but did not long survive the Reformation.

Brethren of the Free Spirit. Pantheistic sect, in Italy, Germany, and France, 1200–1450, holding that one who realizes his identity with God may do what he likes without sin.

Bretigny, PEACE OF. Between Eng. and France May 8, 1360.

Breton, JULES ADOLPHE, b. 1827. French painter of village and country life.

Breton, NICHOLAS, 1555–1624. Eng. pastoral and lyric poet.

Breton, DE LOS HERREROS, 1800–1873. Spanish dramatist, poet, and satirist, author of above 150 plays and 5 vols. of verse.

Bretons. Ancient inhabitants of Great Britain, before the invasion of the Celts. See BASQUES.

Bretschneider, HEINRICH GOTTFRIED. 1739–1810. German poet and satirist. His *Almanac of Saints*, 1788, attacked priests and monks.

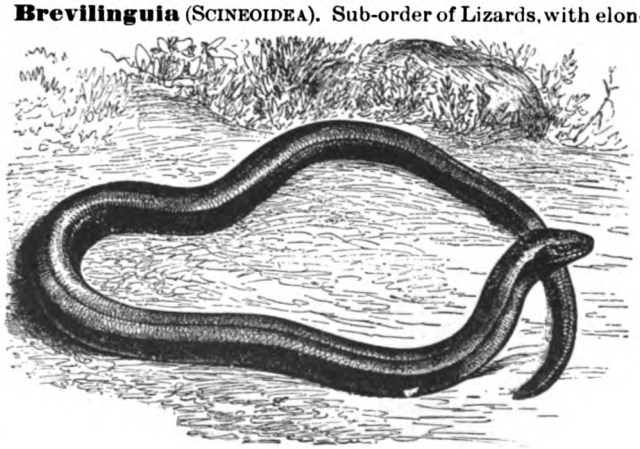
Bretschneider, KARL GOTTLEIB, 1776–1848. German theologian; ed. *Corpus Reformatorum*, 1834 and later. *Manual of Religion*, 1824, tr. 1857.

Bretwalda. Title of certain Anglo-Saxon kings of England; nearly equivalent to emperor.

Brevet. Honorary rank, conferred for meritorious services. It gives no right of command, and can be exercised only by special assignment of the President.

Breviary. R. C. prayer-book, containing offices for the CANONICAL HOURS (q.v.), but not for the Mass. The Roman Breviary is principally in use; Eng. tr. 1879.

Brevilinguia (SCINEOIDEA). Sub-order of Lizards, with elon-



Blind Worm (*Anguis fragilis*).

gated, often snake-like, scaly body, with short, thick tongue, indented at its thin anterior end, and slightly protrusible. Here

belong the Blindworm, and the Skinks or Sand Lizards. The Skinks are tropical or sub-tropical. The Ground Lizard of the s. U. S. is noted for the ease with which it detaches its tail, a new piece (said to be unsegmented) growing in place of the part lost. The Blindworm is not blind; it feeds on insects. Many of the lizard families have representatives resembling snakes, especially the *Anguidæ*, as the Glass Snake, s. of the Ohio. As the long tail breaks off, it has given rise to the mistaken notion that the snake can break into pieces and then each piece can live independently of the other, or even unite again.

Brewer, DAVID JOSIAH, LL.D., b. 1837. Kansas Sup. Ct. Judge 1870–81; U. S. Circuit Ct. Judge 1884; Associate Justice of U. S. Sup. Ct. 1889.

Brewer, EBENEZER COBHAM, D.D., LL.D., b. 1810. English educator, author, and compiler. *Dictionary of Phrase and Fable*, 1870; *Reader's Hand-Book*, 1880; *Miracles*, 1884.

Brewster, BENJAMIN HARRIS, LL.D., 1816–1888. Atty.-Gen. of Pa. 1867; U. S. Atty.-Gen. 1881–85.

Brewster, SIR DAVID, LL.D., D.C.L., 1781–1868. Ed. *Edinburgh Encyc.*, 1808; inventor of the kaleidoscope 1816, and the stereoscope 1850; chief founder of the British Assoc. 1831; knighted 1832. *Optics*, 1831; *More Worlds than One*, 1854; *Life of Sir I. Newton*, 1855.

Brewster, WILLIAM, 1560–1644. Plymouth Pilgrim 1620, and elder.

Brewster's Law. In 1811 Sir D. Brewster made a series of experiments with a view to determining the polarizing angle for light in relation to different media, and connecting them by a general law. The result was that "the index of refraction of a substance is the tangent of the angle of polarization." If α denote the polarizing angle, and a ray of light be incident at this angle, then $\tan \alpha = u = \frac{\sin \alpha}{\cos \alpha}$; but $u = \frac{\sin \alpha}{\sin v}$ where v is the angle of refraction; therefore $\sin v = \cos \alpha$, and $v + \alpha = 90°$. Now the angle of reflection is also α, and therefore the reflected ray and the refracted ray are at right angles; which is another form of this law.

Brialmont, ALEXIS HENRI, b. 1821. Belgian military engineer, maj.-gen. 1874, member Belgian Acad. Sci. 1865, planned Belgium's latest fortifications. Among his many works are *Histoire du Duc de Wellington*, 1856; *Traité de Fortification Polygonale*, 1869; *La Fortification du Temps Présent*, 1885.

Brianchion's Theorem. "The three diagonals of any hexagon circumscribed about a conic meet in a point."

Briareus. One hundred-armed giant, chained under Etna; also called Ægæon.

Briar, SENSITIVE. Prickly herbs of the genus *Schrankia*, natural family *Leguminosæ*, with sensitive bipinnate leaves; natives of e. America, in the warmer regions.

Briar-Wood. Roots, burrs, and knots of *Erica arborea*, a shrub or small tree of the Heath family, native of s. Europe; used for making pipes.

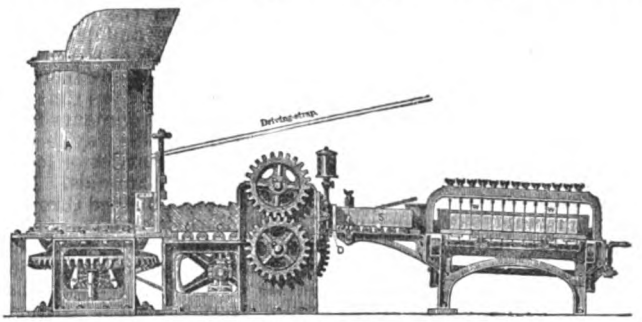
Bribery. Unlawful giving or taking of a pecuniary benefit for the performance of a public duty; ordinarily applied to the corrupt inducement of official action, but several courts have held that a candidate for public office, who offers to serve for less than the legal salary, virtually bribes the voters. It is a common law misdemeanor, now generally defined and governed by statute.

Brice, CALVIN STEWART, b. 1845. U. S. Senator from Ohio 1891.

Brick. Ancient bricks were sun-dried and larger than modern kinds, which are ab. 2x2x8¼ inches in size and weigh ab. 4½ lbs. Pressed brick will weigh ten per cent more. The average compressive strength is ab. 2,500 lbs. per sq. inch, but the best kinds are five times as strong. A common dry brick will often absorb water equal to one-third of its volume or one-seventh of its weight. Three qualities are taken from the kiln; the arch brick, which is near the flames, is hard and often weak and brittle; the body brick, from the interior of the kiln, is of the best quality; the soft are those from the top of the pile.

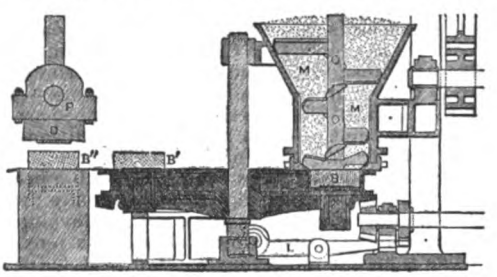
Brick-Kiln. Stone or brick building, usually without a roof, in which green bricks are loosely stacked and burned. In the lower part of the kiln the bricks are piled so as to form arched tunnels which communicate with the exterior by doors where the fire is applied; the heat slowly permeates through the stack. Burning occupies nearly two weeks.

Brick Manufacture. Bricks are made of clay carefully cleaned from sand and pebbles and tempered by hand-stirring or in a pug-mill. They are then molded in rectangular boxes by hand or in a special brick machine (see figures), and are hardened by drying in open sheds, after which they are burned in a kiln. Fire-brick are made from clay, which is free from lime and magnesia. Glazed brick are burned in special furnaces, where a deposit is made upon them by throwing chemicals in



Wet Clay Machine.

the flames. Pressed brick are those subject to a high pressure before burning, thus increasing their weight and strength.



Dry Clay Machine.

Slate-brick are made by grinding up the refuse of slate-quarries, molding and burning as before.

Brick Masonry. The greatest safe stress on brick walls is about 150 lbs. per sq. inch. Walls are usually 8½, 12¾, 17, or 21¼ in. thick, corresponding to 1, 2, 3, 4, etc., bricks. Brickwork is measured by the thousand bricks, the cost of laying being $2 or more per 1,000. Bricks should be wet before spreading the mortar upon them, otherwise they will cause it to dry too quickly. Brick masonry is used for sewers and tunnels, but it rarely has sufficient strength for bridge-piers.

Brick Pavements. Brick was first used for street paving in Holland ab. 1800. In the U. S. it was first used 1872, but is now become very common and gives good satisfaction under light traffic. The brick must be tough, hard, and of slight porosity; that burned by the use of oil or natural gas seems to be best. They are laid on edge in courses across the street on a plank and sand foundation, and cement grout is poured into the joints. The cost per sq. yard ranges from $1 to $2.50, the highest price being when a concrete foundation is used.

Briconnet, GUILLAUME, 1470–1533. Bp. of Lodève 1504, and Meaux 1516. He favored the Reformers till 1523.

Bridge, HORATIO, 1806–1893. Commodore U. S. N. *African Cruiser*, 1845; *Hawthorne*, 1893.

Bridge, JOHN FREDERICK, Mus.D., b. 1844. Composer, and organist of Westminster Abbey since 1882.

Bridge Accidents. Failures of bridges occur by reason of defective construction, derailment of trains, fire and floods. The Ashtabula (see ASHTABULA BRIDGE), and Tay Bridge accidents were due to the first cause. The Tay Bridge was blown down Dec. 1879 while a train was passing, and 75 persons perished; the cast-iron piers were found to be of insufficient strength. The failure of a bridge at Rosindale, Mass., 1887, caused the death of 26 persons. In the ten years preceding 1889 there were 265 bridge failures in U. S. and Canada, of which 34 were caused by defective construction, 60 by derailed trains, and 66 by fire and flood. The accident at Chatsworth, Ill., 1887, caused by the burning of a small wooden trestle, resulted in the death of 73 persons.

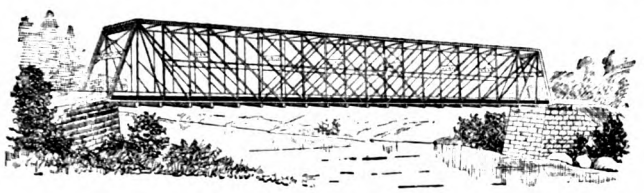
Bridge Loads. In designing highway bridges the trusses are proportioned for the moving load of a crowd of people weighing from 70 to 100 lbs. per sq. foot of floor surface, and also for a snow load ranging from 5 to 20 lbs. per sq. foot, while the floor is computed for concentrated loads on wheels, ab. 2 tons per wheel being a common value. Railroad bridges are proportioned for locomotives weighing from 200,000 to 300,000 lbs., inclusive of tenders, followed by a uniform train load ranging from 3,000 to 4,000 lbs. per linear foot of track. Wind is regarded as a load applied horizontally with a pressure of ab. 30 lbs. per sq. foot of exposed surface. Owing to the rapid increase in weight of railroad rolling stock, many bridges, built but a

few years ago, are now subject to heavier loads than those for which they were designed.

Bridgeport. City of Fairfield co., Conn., on Long Island Sound. It has considerable manufactures of a varied character, including sewing-machines, ammunition, etc. It was incorporated 1819 and chartered 1836. Pop., 1890, 48,866.

Bridges. The three great classes of bridge structures are beam or girder, suspension, and arched bridges, the first class exerting only vertical pressures on their supports, the second a horizontal pull, and the third a horizontal thrust. The various subdivisions of the first class are, simple, draw, continuous, and cantilever bridges. These, as well as aqueduct, railroad, stone, tubular, etc., receive notice under their respective headings. The following is a brief historical summary of bridge development:

The earliest simple bridges were trestle and pile structures like the pons sublicius at Rome, 620 B.C., and Cæsar's bridge over the Rhine, 55 B.C. The truss system of panels was used by Palladio, an Italian architect, ab. 1570, but was not successfully developed until the present century. Wooden trusses were mostly employed until 1840; among these may be noted the Burr, the Long, and the Town lattice truss; they were rarely greater in span than 200 feet, the longest being one of 360 feet, built 1760 in Baden by Grubenmann. Combination trusses, having some of the tensile members made of wrought-iron, were first built by Howe in 1840, and bridges wholly of iron came into use soon after. The pioneer in the U. S. in erecting iron bridges was Whipple, to whom the first exact theory and computations are also due. After 1850 the Pratt truss, the Whip-

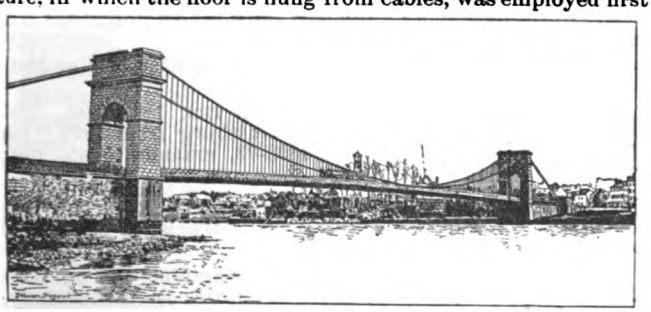


Girder Bridge, Aurora, Ind., 310 ft. span, 18 ft. roadway.

ple truss, and many others were rapidly developed, and several spans longer than 500 feet have been erected since 1880, the longest being the highway and railway span of 550 feet over the Ohio River at Cincinnati. Tubular bridges have not been built in U. S.

Draw bridges, swinging on a central pivot, have been developed since 1850, the greatest being the Thames River draw at New London, Conn., whose length is 503 feet. Continuous bridges resting on several supports have been mainly used in Europe. Cantilever bridges came into use soon after 1880, the first being that at Niagara, and the largest the Forth Bridge in Scotland, with two spans of 1,700 feet each. Steel has largely replaced wrought-iron since 1890 in all classes of bridge structures, its strength being materially greater and cost about the same.

Suspension bridges in the form of a rope carrying a light platform, were in use at a remote antiquity, but the modern structure, in which the floor is hung from cables, was employed first

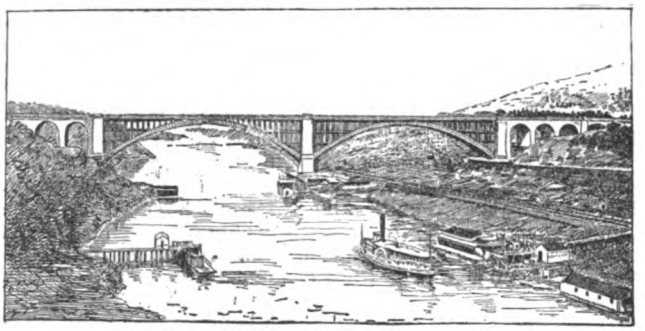


Suspension Bridge over the Scorff, France.

in the U. S. by Finlay in 1805, and its adaptation to railway service was demonstrated by Roebling in 1854 by the construction of the Niagara Bridge. The longest suspension span is the East River Bridge at New York, whose length is 1,595 feet, but plans have been made for one of 3,100 feet over the Hudson.

The earliest arched bridges were of stone and timber; cast-iron was employed late in the eighteenth century. Steel arches of 510 feet span were built 1889 in the highway bridge over the Harlem River at New York, and one of 515 feet, 1873, in the railroad bridge over the Mississippi at St. Louis. The latter, which is the longest arched span, appears to be near the practical limit of length on account of the expense of erection as compared with cantilever and suspension systems.

Over 600 miles of timber and iron bridges have been built on the railroads of the U. S., of which only about 50 miles are spans greater than 200 feet in length. Many bridges have several spans and long viaduct approaches; *e.g.*, the bridge over the Mississippi at Memphis has five spans aggregating 2,600 feet and iron viaduct approaches 2,300 feet in length. The tubular bridge at Montreal has 24 spans of 242 feet each, one of 330 feet, and a total length, including masonry approaches, of



Washington Bridge, Harlem River, N. Y.

6,520 feet. The longest bridge in the U. S. is that over the Ohio at Cairo, Ill., which has two spans of 518 feet, seven of 400 feet, three of 249 feet, and 38 spans of viaduct approaches, making a total of 10,560 feet, or two miles. The longest in the world is the new Tay Bridge in Scotland, which aggregates 10,780 feet.

Iron and steel bridges are either of the riveted system or the pin system. In the former the members of the trusses are connected together by means of rivets, while in the latter steel pins are used, passing through holes in the eye-bars, chords, and posts. Riveted structures are rarely built in the U. S. of greater span than 150 feet, the pin system being more economical, particularly in respect to erection.

The cost of a good railroad bridge of 100 feet span is from $3,000 to $4,000, but for longer spans it increases more rapidly than the length. The Niagara cantilever, 910 feet long, cost ab. $600,000. The proposed suspension bridge over the Hudson at New York, having a central span of 3,100 feet and two shore spans of 1,800 feet each, is estimated to cost ab. $40,000,000. The most economic arrangement is when the cost of the piers and abutments equals the cost of the superstructure.

Bridges, MILITARY. Generally built of pontoons, which for the reserve bridge train are stiff wooden bateaux of such buoyancy as not to be submerged to within four inches of the gunwale when troops are crossing. They are placed 20 ft. apart, anchored up and down stream, and support five roadway stringers, called balks, each 25 ft. long, upon which the chess or plank for the roadway are placed and secured. The pontoon for the advance bridge train consists of a strong open frame, built of two side trusses united by cross transoms, covered with strong canvas. Its buoyancy is less than that of the wooden pontoon, but, as the two boats can be carried on one wagon, its mobility is much greater, and it is therefore used to accompany cavalry.

Bridges, MATTHEW, b. 1800. English hymnist.

Bridges, ROBERT SEYMOUR, b. 1844. English poet. *Prometheus*, 1884; *Eros and Psyche* (tr. Apulcius), 1885; *Nero*, 1885; *Overheard in Arcady*, 1894.

Bridget, ST., or BRIGIT, or BRIDE, 453–523. Irish nun 467; founder of convents at Kildare and elsewhere.

Bridgeton. Capital of Cumberland co., N. J., on Cohansey Creek. Pop., 1890, 11,424.

Bridgetown. Capital of Barbados. Pop., 1891, 21,000.

Bridgewater Gallery. Private gallery in London containing ab. 300 pictures. The most important are three Madonnas by Raphael.

Bridgewater Treatises. Eight works, reconciling Science with Divinity, written by Fellows of the Royal Society (1832–36) in accordance with the bequest of £8,000 by the eccentric Earl of Bridgewater for the best treatise *On the Power, Wisdom, and Goodness of God as Manifested in the Creation.* The authors were Sir Chas. Bell, *The Hand as Evincing Design;* William Kirby (2 vols.), *Power, Wisdom, and Goodness of God in the Creation of Animals;* Jno. Kidd, *Adaptation of External Nature to the Physical Conditions of Man;* Wm. Whewell, *Astronomy and General Physics with Reference to Natural Theology;* Thomas Chalmers, *Adaptation of External Nature to the Moral and Intellectual Conditions of Man;* Wm. Prout, *Chemistry, Meteorology and Digestion with Reference to Natural Theology;* Wm. Buckland (2 vols.), *Geology and Mineralogy with Reference to Natural Theology;* P. M. Roget (2 vols.), *Animal and Vegetable Physiology with Reference to Natural Theology.*

Bridgewater, 8th Earl of, Francis Henry Egerton, 1765–1829. Mentioned in preceding article.

Bridging. Cross-pieces of timber placed between the joists of a floor in order to stiffen them.

Bridgman, Frederick Arthur, b. 1847. American painter, pupil of Gérôme. His favorite subjects are oriental, from studies in Algiers, Egypt, and Nubia.

Bridgman, Laura Dewey, 1829–1889. Blind deaf-mute, successfully educated in Boston by Dr. S. G. Howe, and long a teacher there, though from infancy restricted almost wholly to the sense of touch.

Bridles. In plant anatomy, strands of protoplasm connecting nucleus of cell with exoplasm.

Brief. Sketch of a case in law, prepared for or by counsel.

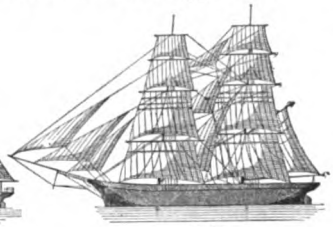
Brief, Papal. Communication less formal and on matters of less weight than a bull.

Brienne. French town on the Aube, where Napoleon attended a military school; scene of a battle Jan. 29-31, 1814, in which he was defeated by the allies under Blucher.

Brier. In England, large kinds of wild roses.

Brig. Two-masted vessel, fully square-rigged on both. The full-rigged brig has fore and main lower masts, topmasts, and topgallant-masts and yards on each, with or without a square mainsail, and carrying also a trysail. The hermaphrodite or half-brig has a brig's foremast and a schooner's mainmast, square rigged forward and fore-and-aft rigged aft.

Brigantine.



Brig.

Brigantine. Two-masted vessel, fully square-rigged except mainsail. Its rig is similar to the hermaphrodite, except that it sometimes carries a light topsail on the mainmast above the large fore-and-aft mainsail.

Brigade. Body of troops, of either arm of the service, consisting of two or more regiments, properly commanded by a brigadier-general.

Brigade of Sappers. One non-commissioned officer and eight sappers. This number is required to push a sap-head steadily in advance. Four sappers are used at a time, the others resting until the time to relieve them, unless drawn upon to supply casualties among the men at work.

Brigandage. Armed robbery by organized gangs, due to the weakness or connivance of the authorities; still existing in Spain, Portugal, Italy, and the Balkan Peninsula. Sicily is pre-eminently the hot-bed of brigandage. In ancient times it was much more general. The Ishmaelites were doomed to perpetual brigandage; Rome was founded by a nest of brigands on the Palatine Hill; the cities of Greece applied the system to each other, and the mediæval robber-nobles reduced it to an art, which, even in modern days, is invested with a kind of sentimental halo.

Briggs, Charles Augustus, D.D., b. 1841. Prof. Union Theol. Sem., N. Y., since 1875; ed. *Presbyterian Review*, 1880–89; tried for heresy 1892. His liberal interpretation of the Calvinistic standards has produced great commotion. *Biblical Study*, 1883; *Whither?* 1889; *Bible, Church and Reason*, 1892.

Briggs, Charles Frederick, 1804–1877. American journalist and novelist. *Harry Franco*, 1839.

Briggs, Henry, 1551–1630. English mathematician; prof. at Oxford 1619. He devised the system of logarithms in common use, having ten as the base.

Bright, John, 1811–1889. English statesman, famous for eloquence and liberalism, associated with Cobden in the Anti-Corn-Law League and other reforms; M.P. from 1843; active in securing household suffrage 1867; cabinet minister 1868–71 and 1880–82.

Bright, William, D.D., b. 1824. Anglican divine and poet. Prof. Oxford 1868; ed, several ancient works; a prolific author.

Brighton. Watering-place of England, on the coast of Sussex, 50 m. s. of London. Pop., 1891, 115,402.

Bright's Disease. Loosely speaking, any disease of the kidneys accompanied by albuminous urine, but properly restricted to an acute form first described in 1827 by Dr. Richard Bright (1789–1858) of London. This usually occurs in early life, those with a pale countenance, light hair, and general flabby appearance being particularly susceptible. Irritating bodies excreted by the kidneys, such as cantharides, copaiba, or turpentine may cause it, and it frequently occurs in connection with typhoid fever, erysipelas, and scarlet fever, the last being probably its most frequent cause. It sometimes is a complication of pregnancy, and may result from the chilling of the warm perspiring body. When not accompanying or masked by some other disease, it manifests itself by fever, headache, pain in the loins and elsewhere, nausea, vomiting, and a marked reduction in the quantity of the urine, which is usually high colored, albuminous, and may contain blood. In a short time dropsy occurs, depending in its extent upon the amount of kidney tissue affected. Recovery is more common than a fatal result; but is slow, often taking many months. Death, when it occurs, is the result of coma or convulsions, caused by the retention within the body of the poisonous matters usually disposed of by the kidneys. The chronic forms, of which there are several varieties, usually due to alcoholism, syphilis, chronic metallic poisoning, malarial influences, gout, or prolonged suppuration, are insidious in their onset, and rarely attract attention until the occurrence of dropsy or perhaps a sudden loss of consciousness. The urine is albuminous and may be either lessened or increased in quantity, and the heart becomes affected by the increased labor thrown upon it. Partial or complete blindness may occur. Death results, as in the acute variety, or from failure of the heart, diarrhœa or brain troubles. Nothing can be done which will replace the affected portions of the kidneys, but if taken in time those unaffected may be preserved. The avoidance of alcohol, rich and highly seasoned food, and, when possible, residence in warm and dry climate, are the principal factors in the treatment. Medication calculated to remove the exciting causes and to relieve any accumulations of fluid is also adopted. It is more than probable that thousands have a slight amount of this disease, but are unconscious of it, and finally die of old age or other cause.

Bright Segment. Portion of the sky above the sun, after sunset; so named 1864 by Bezolet.

Brignoli, Pasquale, ab. 1823–1884. An Italian operatic tenor much admired, especially in U. S., whither he came in 1855.

Bril, Paul, 1554–1626. Flemish painter of landscapes and figures, which show the influence of his Italian travel and studies, and influenced Rubens and Claude Lorrain.

Brill, or Briel. Port of s. Holland, seized by the "Sea Beggars," April 1, 1572, thus beginning the independence of the Netherlands; given to England as security for the advances of Elizabeth 1585; restored 1616.

Brillat-Saverin, Anthelme, 1755–1826. French gastronomist; deputy 1789; member of Court of Cassation 1796. *Physiologie du Gout*, 1825; tr. *Handbook of Gastronomy*, 1884.

Brilliant Green. Similar to Benzaldehyde Green (q.v.) except that it is a tetraethyl compound, and is prepared from ethylaniline instead of methylaniline.

Brimstone. See Sulphur.

Brindisi. Anciently Brundisium, in Calabria, s.e. Italy, on the Adriatic; taken by Romans 267 B.C.; an important seaport. Pop. ab. 17,000.

Brindley, James, 1716–1772. Civil engineer of the Manchester and Liverpool canal.

Brink, Bernard Ægidius Konrad ten, 1841–1892. Philologist, b. at Amsterdam; prof. Strassburg from 1873. His *History of English Literature*, 1883–93, extends to ab. 1560; *Chaucer*, 1870–84; *Beowulf*, 1888.

Brinton, Daniel Garrison, M.D., LL.D., b. 1827. Ethnologist; prof. Univ. Pa. 1886, ed. *Library of Aboriginal American Literature.*

Brinvilliers, Marie Madeleine, Marquise de, ab. 1635–1676. French poisoner who killed her father Dreux d'Aubray, two brothers and her sisters with arsenious acid, in which she was aided by her lover Sainte Croix. Her object was to secure their property. She was beheaded and burned.

Brisbane. Capital of Queensland, Australia, on e. coast, at mouth of B. R. Pop., 1891, with suburbs, 55,959.

Brisson, Eugene Henri, b. 1835. French statesman, pres. Chamber of Deputies 1881–85 and 1894; prime minister 1885.

Brissot de Warville, Jean Pierre, 1754–1793. French writer on criminal law, prominent as a Girondist and guillotined.—His descendant, Felix Saturnin, d. 1892, was an animal painter.

Bristed, Charles Astor, 1820–1874. American author.—His father, John, 1778–1855, wrote *Resources of the British Empire*, 1811, and *of the U. S.*, 1818.

Bristol. Ancient seaport town in w. England, on the Avon, just above its mouth. It is irregularly built, has an extensive commerce, a great shipbuilding industry and large

Bristol.

manufactures, especially of shoes and cotton goods. Pop., 1891, 221,665.

Bristow, GEORGE FREDERICK, b. 1825. American musician, composer of symphonies, overtures and an opera, *Rip Van Winkle*, 1853–80.

Bristow Station, VA. Scene of a battle Aug. 27, 1862, between Gens. Hooker and Ewell. Oct. 14, 1863, the Confederates were repulsed in an attack here.

Britannia. Roman name of England, said to have been called Albion before Cæsar's invasion 55 B.C. The Roman legions were withdrawn ab. 420, and the Britons were soon dispossessed by Angles, Saxons, and other invaders.

Britannia Metal. Alloy of nine parts of tin and one of antimony, with a little copper, used for table utensils.

British America. See AMERICA.

British Association. Founded 1831 by Sir D. Brewster and others "for the advancement of science." It has 8 sections, ab. 4,600 members, and annual meetings of great importance.

British Columbia. Province of the Dominion of Canada, bordering on the Pacific coast; area 341,300 sq. m. The country is mountainous throughout, being in the Rocky Mt. region, and is covered with valuable forests. The coast is exceedingly rugged and broken, bordered by large islands and intersected by fiords. Pop., 1891, 97,612. The industries are agriculture, mining and fishing; Victoria is the capital.

British Gum. DEXTRINE (q.v.).

British Museum. Opened in London 1759; the present building, a fine modern revival of Greek architecture, was erected 1823-47 by Robert and Sydney Smirke. The foundation of the collection dates from 1735, a bequest of Sir Hans Sloane. The Egyptian collection, now of vast extent and importance, dates from the gifts of George III. in 1801. The Antique collections began with the purchase of the Townley Marbles 1805, and of the ELGIN MARBLES (q.v.) in 1816. In the various departments of books and manuscripts, ethnology, coins, Greek and Roman antiquities, mediæval antiquities, etc., there are rare and extensive collections. The Assyrian collection is unrivaled and has no counterpart, except that in the Louvre. The departments of Zoölogy, Botany, Geology and Mineralogy have been moved to the new building at S. Kensington since 1880. A large reading-room was opened 1857. Besides many MSS. there are over 1,600,000 vols. A catalogue is in preparation.

Brito, BENARDO DE, 1569–1617. Portuguese historian.

Britons. Ancient inhabitants of Britain. See BRITANNIA.

Brittany, or BRETAGNE. Ancient province in n. w. of France, formerly known as Armorica, and occupied by Celts and Kymri; divided in 4th century into several republics, which afterward became monarchies. It received much immigration from Britain in 5th and 6th centuries, was subdued by Charlemagne, surrendered to the Northmen by Charles the Simple 912; after fierce resistance became a Norman duchy; and was incorporated with France 1532.

Brittleness. That specific property of a body in virtue of which it may be broken in pieces by a sudden blow. If there be any considerable range of strain for any given stress, the body is said to be tough.

Brittle-Stars. OPHIURIDEA (q.v.).

Brittleworts. See CHARACEÆ.

Britton, NATHANIEL LORD, b. 1859. N. American botanist, prof. Columbia Coll.

Brixham Cave. Small cavern near Torquay, s. England, which, under the examination of Mr. Pengelly, yielded evidence that conclusively established the contemporaneity of man with some of the extinct Mammalia of the district. This discovery was the means of turning public opinion in England upon the antiquity of man.

Brizeux, AUGUSTE, 1806–1858. French idyllic poet.

Broach. Spire in which the angles at the base are filled out with pyramidal masses of masonry, and which is without pinnacles or parapet.

Broad Gauge. Railroad track whose rails are more than 4 ft. 9 in. apart. In England the gauge was 7 ft., and in the U. S. it was 6 ft., but most of these lines have been replaced by the standard gauge of 4 ft. 8½ in. A gauge of 5 feet has been much used in the Southern States. Ireland has a standard gauge of 5 ft. 3 in.; Spain and Portugal 5 ft. 6in.; in Russia most lines are of 5 feet. The broad gauge is generally more expensive, both in construction and operation, than the standard and narrow gauges.

Broadhead, GARLAND C., b. 1827. State geologist of Missouri 1873–75, and afterward prof. State Univ. Columbia, Mo. *Reports and Maps on the Geology of Missouri.*

Broadus, JOHN ALBERT, D.D., LL.D., b. 1827. Prof. Southern Baptist Theol. Sem. 1859, and its pres. 1889. *Preparation and Delivery of Sermons*, 1870.

Broca, PAUL, M.D., 1824–1880. Anthropologist; prof. at Paris.

Brocade. Silk fabric decorated with figures, or often with gold or silver threads.

Broccoli. Modification of the Cabbage plant, *Brassica oleracea*, much resembling cauliflower.

Brochant de Villiers, ANDRE JEAN MARIE, 1772–1840. French geologist, inspector-gen. of mines; prof. School of Mines, Paris, 1815.

Brock, SIR ISAAC, 1769–1812. English general, lieut.-gov. of Upper Canada. He took Detroit 1812 and was killed at Queenstown.

Brocken-Specter. Phenomenon seen on the Brocken, in Hartz Mts., Saxony, and on other mountain-tops where fog and cloud are frequent; as on Adam's Peak, Ceylon. The observer's shadow is at sunrise or sunset thrown nearly horizontally upon a neighboring bank of fog or cloud, and as seen, subtends a large visional angle, thus appearing to be at a great distance and of enormous size.

Brockes, BARTHOLD HEINRICH, 1680–1747. German poet.

Brocket. See DEER.

Brockett, LINUS PIERPONT, 1820–1893. American author and journalist. *History of Education*, 1859; *Woman*, 1869.

Brockhaus, FRIEDRICH ARNOLD, 1772–1823. Founder of a publishing house in Leipzig, carried on by his son, HEINRICH, 1804–1874, and grandsons. Prominent among their publications is the *Conversations Lexicon*, 1809 and later.—Another son, HERMANN, 1806–1877, was prof. of Sanskrit at Leipzig from 1848.

Brockton. City of Plymouth co., Mass., orig. N. Bridgewater, noted for its shoe-factories. Pop., 1890, 27,294.

Broderick, DAVID COLBRETH, 1820–1859. U. S. Senator from Cal. 1857; killed in a duel by Judge D. S. Terry.

Brodhead, JOHN ROMEYN, LL.D., 1814–1873. Sec. U. S. legation at The Hague 1839–44, and at London 1846–49. *History of New York State*, 1853–71.

Brodhead, RICHARD, 1811–1863. M.C. 1843–49; U. S. Senator 1851–57.

Brodsky, ADOLPH, b. 1851. Russian violinist; leader of the violins of N.Y. Symphony Society 1891–93.

Broekhoven, JOHN ANDREW, b. 1852, in Holland. American composer in Cincinnati since 1868. *A System of Harmony*, 1889; *Suite Creole* for orchestra; *Overture Columbia.*

Broglie, ACHILLE LEONCE VICTOR CHARLES, DUC DE, 1785–1870. French statesman, Academician 1856.—His son, JACQUES VICTOR ALBERT, b. 1821, held office under MacMahon, 1871–77, and has pub. historical works.

Brokage. Arrangement made through the agency of a broker or go-between; premium on a broker's commission; buying and selling stocks and other securities for others.

Broker. Agent who undertakes in a commercial transaction to bring the minds of the parties to an agreement upon the terms of a contract. His commissions are earned upon procuring such agreement; he has no lien for commissions generally, as he has not possession of the subject matter of the contract; he may act for both parties, being a middleman, and not an agent in whom peculiar trust is placed by one of the contracting parties.

Bromal. $CBr_3.CHO$. Bpt. 174° C. Tribromoacetaldehyde, prepared by the action of bromine upon alcohol; oxidized easily to tribromoacetic acid. It combines with water to form bromal hydrate. See CHLORAL.

Bromal Hydrate. $CBr_3.CHO,H_2O$. Mpt. 53.°5 C. Combination of bromal with water; white crystalline substance. See CHLORAL HYDRATE, which it closely resembles.

Bromargyrite, or BROMYRITE. AgBr. Compound of bromine and silver, found in Chili and in Mexico, valuable as an ore of silver.

Brom Compounds. Derived by the replacing of hydrogen by bromine The bromides are compounds whose name signifies a combination of a group with bromine, and may often be regarded both as brom compounds and as bromides; *e.g.*, $CH_3.Br$ may be called bromomethane or methyl bromide.

Brome, ALEXANDER, 1620–1666. English poet and dramatist.

Brome, RICHARD, d. 1652. English dramatist.

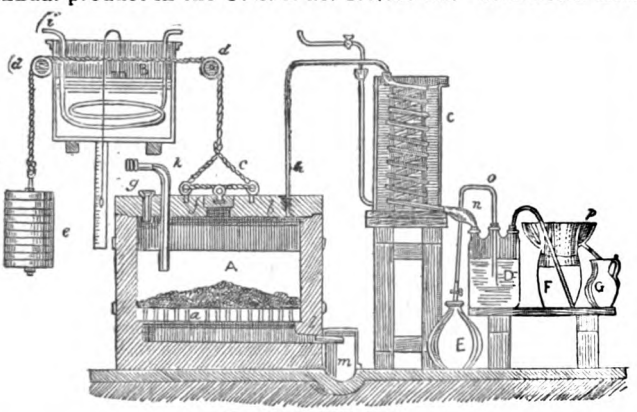
Brome-Grass. Grasses of the genus *Bromus*.

Bromeliaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Monocotyledones*, comprising 38 genera and ab. 525 species, all natives of the tropics and adjacent lands of America; commonly called the Pineapple family.

Bromic Acid. $HBrO_3$. It cannot be obtained pure, owing to its instability. It is made by treating silver bromate with bromine and water.

Bromides. Salts of hydrobromic acid, result of action of bromine on another element. Those of calcium, ammonium, potassium and sodium are the ones most commonly employed in medicine, and are almost identical in effects. They are used to relieve sleeplessness and nervous irritability, especially when due to worry or overwork, in delirium, headache, sexual excitement, and epilepsy. If used too long or in too large doses, they disturb the digestion and set up a condition known as bromism, in which occur anæmia, an eruption upon the skin, foul breath, weak action of the heart, loss of sexual power, muscular tremors, and mental disturbance amounting often to idiocy. These symptoms disappear shortly after the discontinuance of the bromide.

Bromine. Br. At.wt. 79.95. Sp. gr. 3.18 liq. Mpt. 7°.02 C. Bpt. 58°.7 C. Discovered by Balard 1826. It occurs in combination in sea-water, certain mineral waters, and rock-salt deposits. It is prepared by heating magnesium bromide and chloride, manganese dioxide, residues from the above, and sulphuric acid. It is a heavy reddish brown liquid, the vapors of which strongly irritate the eyes and the mucous membrane. It is slightly soluble in water, easily in alcohol and ether. It acts violently on organic substances; if it come in contact with the flesh it produces ugly burns, which are difficult to heal. Bromine and its compounds are used in medicine, photography, and in the manufacture of coal-tar colors. The annual product in the U. S. is ab. 400,000 lbs. It is never used



Bromine Distillation.

undiluted except as an application to mortified flesh, but in solutions of the strength of one part in ab. 5,000 of water there is scarcely any disinfectant so valuable or so easily used, the only precaution necessary being the avoidance of metallic bodies, which it corrodes. Abattoirs, stables, and similar places are rendered free from all offense by its use. Stronger solutions may be mixed with clay, infusorial earth, etc., and scattered around or placed in vessels where a slow giving off of the vapor is desirable to counteract offensive odors which are evolved continuously.

Bromoacetic Acid. $CH_2Br.COOH$. Mpt.50°, Bpt. 208° C. White crystalline body, prepared by heating acetic acid with bromine; monobasic acid, blistering the skin if in contact with it.

Bromobenzene, or BROMOBENZOL. $C_6H_5.Br$. Phenyl bromide, Bpt. 155° C., product of the action of bromine upon benzene. The bromine replaces the hydrogen, and hydrobromic acid is also formed; heavy liquid.

Bromoethane. $CH_3.CH_2Br$. See ETHYL BROMIDE.

Bromoethylene. CH_2:CHBr. Bpt. 16°C. Ethylene (CH_2:CH_2) in which one atom of the hydrogen has been replaced by bromine; liquid prepared by the action of caustic potash upon ethylene bromide.

Bromoform. $CHBr_3$. Bpt. 152° C. Tribromomethane. Heavy liquid, prepared by the action of alkali upon bromal.

Bromonaphthalene. $C_{10}H_7Br$. Known in two forms, α and β. The α compound is a liquid, Bpt. 277° C., prepared by direct action of bromine upon the hydrocarbon naphthalene. The β compound is prepared from the β-naphthylamine. Solid, melting at 59° C.

Bromophenol. C_6H_4:OH.Br. Known in three forms, ortho-, meta-, and para-. The parabromophenol is the main product of the action of bromine upon phenol or carbolic acid. Mpt. 64° C.

Bromwich, WEST. Manufacturing town of Staffordshire, Eng. It has large manufactures of hardware. Pop., 1891, 56,295.

Bronchial Tubes. Canals which distribute the air to the lungs. They commence by the division of the trachea into two branches, the bronchi, one for each lung, which in turn divide and subdivide, the whole system being comparable to the trunk of a tree, its branches and twigs, until they are about $\frac{1}{25}$ of an inch in diameter. From these are given off branches into which the air-cells or alveoli open.

Bronchidesmus. Membrane uniting the bronchi, in birds.

Bronchiectasis. Chronic dilatation of a bronchus, with inflammation of lung immediately surrounding. Symptoms similar to those of consumption. Expectoration lumpy and frequently offensive. Treatment: Cod-liver oil, tonics and antiseptic inhalations.

Bronchitis. Inflammation of the bronchial tubes, generally of the larger ones, accompanied, when acute, by slight fever, increased secretion, and cough. The chronic form is without fever, is apt to recur every winter, may finally become continuous, and is often the result of inhaling irritating substances. When the finer tubes are affected, it is called capillary, and often causes death by suffocation, especially in the aged and the very young. The acute variety, or a severe cold, rarely endangers life, and the chronic not often, except by exhausting the strength of those already debilitated.

Broncho. See HORSE.

Bronchocele. See GOITRE.

Bronchotomy. Surgical opening into the larynx, trachea or a bronchial tube.

Bröndsted, PETER OLUF, 1780–1842. Danish archæologist, prof. at Copenhagen 1813, envoy at Rome 1819. *Travels in Greece*, 1826–30; *Greek Vases*, 1832; tr. Æschylus, 1842–44.

Brongniart, ALEXANDRE, 1770–1847. French naturalist, eminent in several diverse fields; director of the porcelain works at Sèvres from 1800, member of the Institute 1815. *Classification of Reptiles*, 1805; *Mineralogy*, 1807; *Trilobites*, 1814; *Ceramic Arts*, 1845.—His son, ADOLPHE THEODORE, 1801–1876, prof. of Botany in Paris 1833, pub. *Phanérogams*, 1827, and *Vegetable Fossils*, 1850. He was the first to study the fragmentary remains of extinct flora and trace their relations to living plants.

Bronsart, HANS VON. b.1830. German pianist, composer and opera director, pupil of Liszt, Kullak and Dehn.

Brontë, ANNE ("ACTON BELL"), 1820–1849. English novelist, sister of CHARLOTTE. *Agnes Grey*, 1847; *Tenant of Wildfell Hall*, 1848.

Brontë, CHARLOTTE ("CURRER BELL"), 1816–1855. English novelist. *Jane Eyre*, 847; *Shirley*, 1849; *Villette*, 1852; author, with her two sisters, of *Poems by Currer, Ellis, and Acton Bell*, 1846. In 1854 she became Mrs. A. B. Nichols.

Brontë, EMILY JANE ("ELLIS BELL"), 1818–1848. English poet and novelist. *Wuthering Heights*, 1847.

Brontometer. Instrument for registering the time of beginning and ending of lightning and other phenomena of thunder storms.

Brontosaurus. Dinosaur, ab. fifty feet long, with long neck, small head, heavy tail, and five toes. It had no weapons, and must have been protected by mere size; but it was easily mired, and thus we find the skeletons to-day.

Brontotheridæ. Family of *Perissodactyla*, comprising fossil, tapir-like animals, found in the Miocene deposits of N. America by Prof. Marsh. The hind feet had three, the fore feet

four, nearly equal toes; the tail and neck were long. There is no diastema between the canines and præmolars; the nasals and maxillaries carry a pair of large horn-cores. *Brontotherium*, which probably resembled the elephant, is typical of the family, but several allied genera have been discovered.

Bronze. Copper, 8 parts, and tin, 1 part, form a bronze used for gun-metal which weighs ab. 530 lbs. per cubic foot. There are many varieties of bronze, depending upon the proportions of copper and tin. Sometimes zinc and lead are added. See COPPER, METALLURGY OF.

Bronze Age. Prehistoric period in Europe following the age which had no knowledge of metals, but used stone, shell, and horn implements; succeeded by that in which iron was introduced. Bronze was known in Egypt 4000 B.C., but probably not to the Swiss lake-dwellers before 2000 or 1500 B.C., and its use in n. Europe was still later. The divisions of the Stone, Bronze, and Iron Ages are especially emphasized in Scandinavian archæology, because the Scandinavian relics of all these periods are so numerous and the distinctions of culture so clear. The use of stone continued long after bronze was first used, and iron never wholly supplanted bronze. Students are not yet agreed as to the original center of the Bronze Age and attendant culture, but there is no evidence to connect it with Asia.

Bronzino, AGNOLO, 1503–1572. Painter of the Florentine decadence. His best works are portraits, especially in the Pitti Gallery.

Brood-Pouch. Sac either internal or external to the body of animals, in which the early stages of the development of the young are passed when there is little or no nutriment passing from the mother to the young, the eggs being adequately supplied with food-yelk. Otherwise such a sac is a uterus, if internal, and a marsupium, if external. See EPHIPPIUM.

Brooke, GUSTAVUS VAUGHAN, 1818–1866. Irish actor.

Brooke, HENRY, 1703–1783. Irish poet and novelist. *Gustavus Vasa*, 1739, and other plays. His *Fool of Quality*, 5 vols., 1766–70, was abridged by John Wesley 1780, and repub. in 2 v., 1859–60.

Brooke, HENRY JAMES, 1771–1857. English crystallographer; author of articles on mineralogy in *Encyc. Metripolitana.*

Brooke, SIR JAMES, 1803–1868. Rajah of Sarawak, at first under the Sultan of Borneo, and later as an independent sovereign; knighted 1847; British gov. of Labuan 1848–57. In Sarawak he suppressed the head-hunters and pirates 1838–46, repelled a Chinese invasion 1857, made laws, fostered trade, and left his throne to a relative.

Brooke, LORD. See GREVILLE, FULKE.

Brooke, STOPFORD AUGUSTUS, b. 1832. Biographer of F. W. Robertson 1865. *Theology in the English Poets*, 1874; *English Literature*, 1876; *Poems*, 1888.

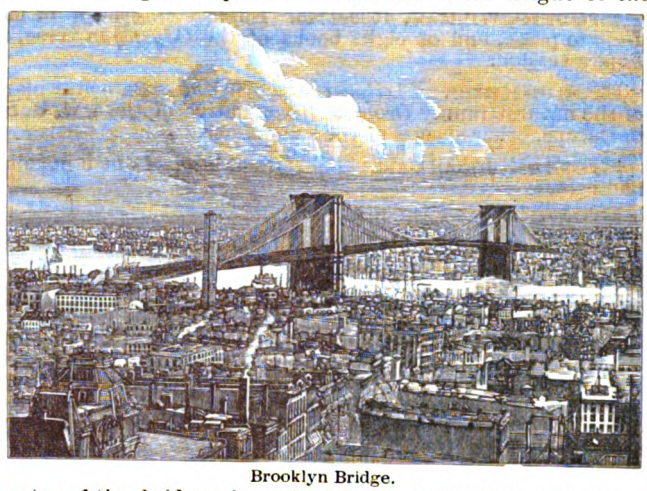
Brook Farm. Included some 200 acres at West Roxbury, Mass., where, in 1841, the Transcendentalists formed a settlement with the object of combining cultivation of mind and heart with a reasonable amount of common daily labor. Members received 10 cents an hour for their work, whether as teachers, field or stable hands, joiners, shoemakers, or seamstresses, and all shared alike. The scheme failed financially in 1847. It was first started as a joint-stock company, reorganized as a phalanstery 1844, and incorporated as the Brook Farm Phalanx 1845. Among the members were George Ripley, C. A. Dana, G. W. Curtis, Theodore Parker, W. H. Channing, R. W. Emerson, Margaret Fuller, Alcott, Brownson, and others.

Brooklime. *Veronica Beccabunga* and *V. Americana.* Aquatic herbs of the natural family *Scrophularineæ*, natives of Europe and N. America.

Brookline. Suburb of Boston; in Norfolk co., Mass., on Charles R. Pop., 1890, 12,103.

Brooklyn. City of Kings co., N. Y., second in population in the State and fourth in the U. S., at w. end of Long Island. It covers an area of 32 sq. m., is the terminus of a number of short railroads, and is connected with New York by the East R. Suspension Bridge and numerous ferries. It has ab. 700 miles of streets, mostly paved with cobble-stones. Water is obtained by pumping from Jamaica Pond and elsewhere, some 50,000,000 gals. being used daily. Prospect Park has an area of 516 acres. The sewer system is very complete, the sewerage being discharged into East R., Gowanus Bay, and Wallabout Bay. The principal cemetery, Greenwood, is one of the most beautiful in the country. The U. S. maintains a navy yard here. The first settlement was made 1636. It was incorporated 1653–65, chartered as a village 1816, and as a city 1834. Williamsburg and Greenpoint were added 1855. Pop., 1890, 806,343.

Brooklyn Bridge. Over the East River between New York and Brooklyn, erected 1870–83 at a cost of ab. $15,000.000; 6,537 ft. long, having a central span of 1,596 ft. and two side spans of 930 ft. each, the longest of all suspension structures. There are four cables of steel wire, each 16 inches in diameter and containing 5,296 parallel wires. The clear height of the



Brooklyn Bridge.

center of the bridge above high water is 135 feet. The plans were made by John A. Roebling; his son. W. A., was the chief engineer. The bridge is free to foot passengers, but the total annual receipts from wagons and the cable railway are nearly $2,000,000.

Brooks, CHARLES TIMOTHY, 1813–1883. Unitarian pastor at Newport, R. I., 1837–73; translator of *Faust*, 1856, and many other German poems.

Brooks, CHARLES WILLIAM SHIRLEY, 1815–1874. English novelist and dramatist; ed. *Punch*, 1870; *Aspen Court*, 1857; *Sooner or Later*, 1868.

Brooks, MRS. MARIA GOWEN, ab.1795–1845. American poet. *Zophiel*, 1825–33. Southey called her "Maria del Occidente," and praised her in his *Doctor.*

Brooks, NATHAN COVINGTON, b. 1819. American author of Greek and Latin text-books.

Brooks, NOAH. b. 1830. American journalist, author of stories for boys. *Tales of Maine Coast*, 1894.

Brooks, PHILLIPS, D.D., 1835–1893. Rector in Phila. 1859; Boston 1869; Bp. of Mass. 1891; accounted the greatest of American preachers since H. W. Beecher's death. *Lectures on Preaching*, 1877; *Influence of Jesus*, 1879.

Brooks, WILLIAM KEITH. Ph.D., b. 1848. Director Chesapeake Marine Laboratory 1878, prof. of Morphology at Johns Hopkins Univ. 1883. *Invertebrate Zoölogy*, 1882; *Heredity*, 1884.

Brooks' Theory of Heredity. Modification of the pangenesis theory, in which it is assumed that the sperm is the specialized cell into which gemmules are stored, which are given off by the various somatic cells only when a strain, due to ill adaptation, occurs. Thus sex is explained as a differentiation between conservative and radical lines (stability and variation), represented by the female and the male respectively. All, or mainly all, variation originates in the male. The theory claims that some organs, now found rudimentary in the male and well developed in the female (as the mammæ), originated in the former and have been transferred to the latter. Many facts seem to support this theory, but there are exceptions enough to prevent its acceptance unconditionally.

Brookweed. *Samolus Valerandi.* Plant of the Primrose family, native in Europe; known also as Water Pimpernel.

Broom. *Cytissus scoparius.* Shrub of the Bean family, bearing a profusion of yellow flowers; native of Europe, introduced into N. America. Its twigs are used for making brooms.

Broom, HERBERT, LL.D., 1815–1882. English lawyer. *Legal Maxims*, 1845; *Commentaries on the Common Law; Philosophy of Law*, 1876–78.

Broom, BUTCHER'S. *Ruscus aculeatus.* Stiff, spiny shrub of the Lily family, native of Europe.

Broom-Corn. *Sorghum vulgare.* Coarse grass, native of Asia, extensively cultivated in the U. S. The long axes of the spikelets are used in making brooms. A warm, rich, alluvial

soil is especially suited to this crop. The seed-bed must be well prepared and the planting not done till the ground is thoroughly warm. Cultivation is the same as for Indian corn. When the seed-panicles appear the head is broken over (tabled), so that the weight of the maturing seed may cause the brush to grow straight. When the seed is ripe, the heads and upper part of the stalk are cut off, the seed scraped off, and the brush packed in bundles for sale.

Broome, WILLIAM, 1689–1745. English translator of the *Iliad* in prose, and of eight books of the *Odyssey* in verse, in Pope's version.

Broom-Rape. *Phelipæa Ludoviciana.* Parasitic plant of the natural family *Orobanchaceæ*, native of the s. w. U. S.; in Europe, other species of the same order.

Brosboll, JOHAN CARL CHRISTIAN, b. 1820. Danish novelist and poet.

Broschi. See FARINELLI.

Brothers of the Bridge. Mediæval, semi-religious fraternity, founded to secure travelers safe passage across rivers, and afterward engaged in bridge construction. Peter of Colechurch, a priest, built the first stone bridge in London ab. 1180.

Brougham, HENRY, LORD, 1779–1868. Statesman and author, b. in Edinburgh, removed to London 1808; M. P. 1810, Baron Brougham and Vaux 1830, Lord Chancellor 1830-34; eminent as an orator and a legal, social, and educational reformer. *Statesmen of Time of George III.*, 1839-43; *Political Philosophy*, 1840–44; *British Constitution*, 1844; *Works*, 10 vols., 1857; *Memoir*, 1871.

Brougham, JOHN, 1810–1880. Irish-American actor and dramatist. settled in N.Y. from 1842, except 1860-65; connected with Burton and Wallack, and twice a manager. His writings and parts were all in comedy.

Broughton, RHODA, b. 1840. English novelist. *Cometh up as a Flower*, 1867: *Red as a Rose is She*, 1870; *Good-bye, Sweetheart*, 1872; *Doctor Cupid*, 1886.

Brouncker, WILLIAM, VISCOUNT, 1620–1684. English mathematician, first pres. Royal Society. He investigated the properties of continued fractions, and contributed memoirs to *Philos. Transactions.*

Broussa, or BURSA. City of n. w. Asia Minor, n. of Mt. Olympus, ancient capital of Bithynia; taken by Turks 1356, capital of their sultans till 1453.

Broussais, FRANCOIS JOSEPH VICTOR, 1772–1838. French army surgeon, prof. Paris 1832: founder of the physiological school. *Medical Doctrine*, 1816.

Brouwer, or BRAUWER, ADRIAN, 1606–1638. Flemish genre painter, who affected tavern subjects and low life, and had no superior in his own field.

Brown, CHARLES BROCKDEN, 1771-1810. American novelist; ed. *Literary Magazine*, 1803–8; *Wieland*, 1798; *Ormund*, 1799; *Arthur Mervyn*, 1800; *Jane Talbot. Edgar Huntley*, and *Clara Howard*, 1801. These crude but powerful tales were reprinted 1857.

Brown, DAVID PAUL, 1795–1872. Phila. lawyer and dramatist. *The Forum*, 1856.

Brown, FORD MADOX, b. 1821. English painter of the æsthetic school. Frescoes in Town Hall of Manchester.

Brown, FRANCIS, D.D., 1784–1820. Pres. Dartmouth Coll. 1815.—His grandson and namesake, b. 1849, has been prof. Union Theol. Sem., N.Y., since 1881. *Assyriology*, 1885.

Brown, SIR GEORGE, 1790–1865. British general. He served in Peninsula and Crimean Wars, and commanded the storming party in the first attack on the Redan 1856.

Brown, GEORGE LORING, b. 1814. American landscape painter.

Brown, HENRY BILLINGS, LL.D., b. 1836. U. S. Dist. Judge E. Dist. of Mich. 1875; Associate Justice U. S. Sup. Ct. 1890.

Brown, HENRY KIRKE, 1814–1886. American sculptor. Equestrian statue of *Washington*, Union Square, N. Y.

Brown, JAMES BALDWIN, 1820–1884. Pastor in London from 1846. *Doctrine of Annihilation*, 1875: *Home*, 1883.

Brown, JOHN, M.D., 1810–1882. Scottish essayist. *Horæ Subsecivæ*, 1858–82, included *Rab and his Friends.*—His great-grandfather, JOHN BROWN of Haddington, 1722–1787, pub. *Dictionary of the Bible*, 1768, and *Self-Interpreting Bible*, 1778.

Brown, JOHN (OF OSSAWATOMIE), 1800–1859. Abolitionist. He went to Kansas 1855 and took part in the struggle between the free-state and pro-slavery men; conceived the idea of freeing slaves by inciting them to insurrection; seized the arsenal at Harper's Ferry, Va., Oct. 16, 1859. It was retaken the following day, and he was tried and executed Dec. 2.

Brown, JOSEPH EMERSON, LL.D., 1821–1894. Gov. of Ga. 1857–65, chief-justice 1868–70, pres. Western and Atlantic R. R. 1870, U. S. Senator 1881–91.

Brown, MRS. PHŒBE (HINSDALE), 1783–1861. American hymnist; author of "I love to steal awhile away," 1817.

Brown, ROBERT, ab.1550–1633. Reputed founder of English Congregationalism. He formed a separatist society at Norwich 1581, but after frequent imprisonment conformed to the Church 1586, and received a benefice 1591; said to have died in jail. His first followers were called Brownists.

Brown, ROBERT, 1773–1858. English botanist. *Flora of New Holland*, 1810–27; *Works*, 1866–68.

Brown, THOMAS, M.D., 1778–1820. Philosopher; the first to distinguish between tactual and muscular sensations and to develop the doctrine of association in the explanation of fundamental beliefs. *Lectures on the Philosophy of the Human Mind.*

Brown Body. Mass formed in the older parts of colonies of marine *Polyzoa*, from the degeneration of the zoöids except the reproductive tissues of the endocyst; sometimes absorbed by new buds from the latter.

Brown Coal. Containing carbon 48–56 per cent, hydrogen, 1–2 per cent, chemically combined water 31–32 per cent, and ab. 20 per cent hygroscopic water. It frequently shows direct evidence of its vegetable origin. It is rather widely distributed, bnt its deposits are usually limited in extent and lie mostly near the surface in the younger geological formations. Though of inferior value as a fuel, it is used where fuels of better quality are not obtainable.—See LIGNITE.

Browne, CHARLES FARRAR ("ARTEMUS WARD"), 1834–1867. American humorist. His articles began to attract attention ab. 1858 in the Cleveland, O., *Plaindealer*. He removed to N.Y., ed. *Vanity Fair* for a time, and took to lecturing ab. 1862. *A. Ward, his Book*, 1862; *His Travels*, 1865; *In London*, 1867; *Works*, 1875.

Browne, EDWARD HAROLD, D.D., D.C.L., 1811–1891. Bp. of Ely 1864, Winchester 1873. *Exposition of the 39 Articles*, 1850–53.

Browne, HABLOT KNIGHT, 1815–1882. English book illustrator. He illustrated Dickens's works.

Browne, JOHN ROSS, 1817–1875. Irish-American traveler; U. S. Minister to China 1868–69. *Yusef*, 1853; *Crusoe's Island*. 1864; *Land of Thor*, 1866.

Browne, SIMON, ab. 1680–1732. London dissenter, who thought himself devoid of "a reasonable soul"; author of several learned books, and of many hymns, 1720.

Browne, SIR THOMAS, 1605–1682. English essayist, knighted 1671. *Religio Medici*, 1643; *Pseudoxia Epidemica*, 1646-50; *Urn Burial*, 1658.

Browne, THOMAS ALEXANDER ("ROLF BOLDREWOOD"), b. 1828. Australian novelist. *Ups and Downs*, 1879; *Nevermore*, 1891; *A Sidney Side Saxon*, 1891.

Browne, WILLIAM, ab. 1590–ab.1643. English poet. *Britannia's Pastorals*, 1613–16; *Works*, ed. 1772, 3 vols.

Brownell, HENRY HOWARD, 1820–1872. American author, styled by Dr. Holmes "Our Battle Laureate"; nephew of Bp. T. C. *War Lyrics*, 1865.

Brownell, THOMAS CHURCH, D.D., LL.D., 1779–1865. Prof. Union Coll. 1806, Bp. of Conn. 1819. *Family Prayer-Book*, 1823.

Brownell, WILLIAM CRARY, b. 1851. American author. *French Traits*, 1889; *French Art*, 1892.

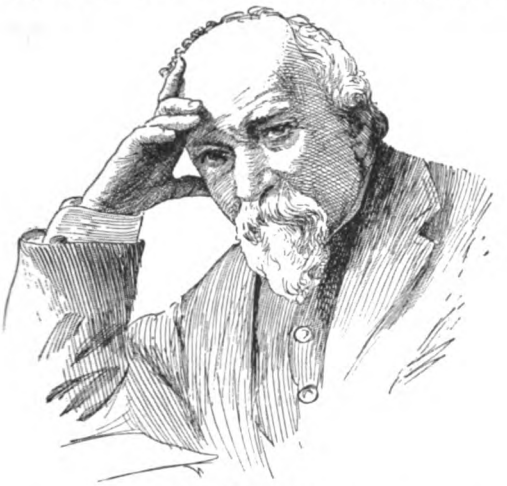
Brownian Motion. See PEDESIS.

Brownie. Scottish house-spirit of tawny color, who does little services for the family he chooses to live with.

Browning, MRS. ELIZABETH BARRETT, 1806–1861. English poet of highest rank, married to ROBERT B. 1846, and thenceforth resident in Italy. Her most noted works are *Aurora Leigh*, 1856, and the so-called (original) *Sonnets from the Portuguese*, 1850. Her intense temperament found expression in some of the finest ballads in the language.

Browning, ROBERT, 1812–1889. Most intellectual of English poets since Milton, and most introspective since Shakespeare's Sonnets; a verse-making psychologist, who seemed to despise popularity and aim at obscurity, though of singular dramatic power. A few of his poems are for all readers; most are for a few. *Paracelsus*, 1836; *Strafford*, 1837; *Sordello*, 1840;

Blot in the Scutcheon, 1843; *Christmas Eve and Easter Day*, 1850; *Men and Women*, 1855; *Dramatis Personæ*, 1864; *The Ring and the Book*, 2 vols., 1868–69; *Balaustion's Adventure*, 1871; *Fifine at the Fair*, 1872; *Red Cotton Nightcap Country*, 1873; *Aristophanes' Apology*, 1875; *La Saisiaz*, 1878; *Dramatic Idylls*, 1879–80; *Asolando*, 1889. His fame came slowly, but Browning Societies in England and America are now studying his works, an



Robert Browning.

honor given in equal measure to no other English poet but Shakespeare.

Brownlow, WILLIAM GANNAWAY, 1805–1877. Ed. *Knoxville Whig*, 1837; imprisoned and exiled as a Union man 1861–62. Gov. Tenn. 1865–69; U. S. Senator, 1869–75.

Brown-Séquard, CHARLES EDOUARD, M.D., 1817–1894. B. in Mauritius. French physiologist, prof. Harvard Coll. 1864–68; prof. Paris 1869, 1878; resident in U. S. 1873–78. *Nervous System*, 1860; *Paralysis*, 1860; *Nervous Affections*, 1873.

Brownson, ORESTES AUGUSTUS, LL.D., 1803–1876. American controversialist. After passing through various grades of Protestantism, he joined the R. C. Ch. in 1844, and expounded its tenets in his *Quarterly Review* till 1864. *Charles Elwood*, 1840; *The Convert*, 1857. His *Works*, 1883–85, fill 19 vols.

Brown Swiss. See CATTLE.

Brown University. Founded 1764 at Warren, R. I., as R. I. College; removed to Providence in 1770. Its name was changed 1804 in honor of Nicholas Brown, a benefactor. The Baptists have a majority in the board of control. It has funds of $1,300,000, a library of 80,000 vols., 62 instructors, and ab. 550 students, of whom ab. 90 are graduates.

Brow-Spot, or INTEROCULAR GLAND. Between the eyes, in Frogs and Toads. It has given rise to the myth of the jewel in the toad's head. See EPIPHYSIAL or PINEAL EYE.

Bruce, ALEXANDER BALMAIN, D.D., b. 1831. Scottish theologian; prof. Free Ch. Coll., Glasgow, 1875. *Apologetics*, 1892.

Bruce, ARCHIBALD, M.D., 1777–1818. Mineralogist. Prof. N.Y. 1807; Rutgers Coll. 1812.

Bruce, DAVID. See DAVID II.

Bruce, JAMES, 1730–1794. Scottish explorer in Africa; discoverer of the source of the Blue Nile, 1770. *Travels*, 5 vols., 1790.

Bruce, MICHAEL, 1746–1767. Scottish poet, whose lyrics, including several of the Paraphrases, were stolen by John Logan. They were collected 1865.

Bruce, ROBERT, 1274–1329. King of Scotland 1306; soon driven to Ireland, but returned 1307; defeated Edward II. 1309, and at Bannockburn 1314; acknowledged by England 1328; succeeded by his son, DAVID II.—His brother EDWARD was king of Ireland 1316–17.

Brucine. $C_{23}H_{26}N_2O_4$. Mpt. 178° C. Alkaloidal base, present in the *Strychnos nux-vomica*, and in other beans. Poisonous, but less violent in its action than strychnine, which it accompanies.

Brucite. H_2MgO_2. Natural magnesium hydrate, occurring in lamellar and in fibrous forms, and associated with other magnesium minerals in serpentine; named in honor of Dr. Archibald Bruce.

Brücke, ERNST WILHELM, 1819–1892. German physiologist; prof. at Vienna from 1849.

Brucker. JOHANN JAKOB, 1696–1770. Pastor at Augsburg 1744. *History of Philosophy*, 5 vols., 1741–44.

Bruckner, ANTON, b. 1824. Austrian organist, composer of masses and symphonies; prof. Vienna; strong adherent of the Wagner cause.

Bruges. City of Belgium, noted for its manufactures of

Town Hall, Bruges.

laces, woolens, cotton, and linen goods. In the 14th and 15th centuries it was a commercial and manufacturing center of the first importance. Pop., 1891, 47,331.

Brugmann, KARL, b. 1849. Prof. Comparative Philology at Leipsic. *Grundriss der vergleichenden Grammatik der indogermanischen Sprachen*, 1886–90.

Brugsch, HEINRICH KARL, 1827–1894. German Egyptologist; prof. at Göttingen 1868; keeper of the Museum at Boulak 1869–81; made Bey and Pasha. *Demotic Grammar*, 1855; *Hieroglyphic Dictionary*, 7 v., 1867–82; *Hist. Egypt under the Pharaohs*, 1877, tr. 1879.

Brüll, IGNAZ, b. 1846. German pianist and composer. His most successful work, the opera *Das goldene Kreutz*, 1875, was produced in N.Y. 1886.

Brun, JOHAN NORDAL, 1745–1816. Norwegian lyric poet.

Brunanburh. In England, near the Humber. Here Northmen from Ireland and Scots were defeated with great slaughter by Athelstan 937.

Brunehilde. Wife of Siegburt, king of Austrasia. She ruled as regent for her son, Childebert, who d. 596; stirred up war between her grandsons, Theodobert and Theodoric II., again assumed the regency at 80, and was dragged to death at the tail of a wild horse.—B. of the Nibelungen Lied, one of the Valkyrie of Northern mythology.

Brunel, ISAMBARD KINGDOM, D.C.L., F.R.S., 1806–1859. English civil engineer; designer of the *Great Eastern* steamship and of the Saltash bridge.—His father, SIR MARK ISAMBARD, F.R.S., 1769–1849, a French refugee, constructed the Thames tunnel 1825–43.

Brunelleschi, FILIPPO, 1377–1446. Florentine architect, designer of the Pitti Palace, the dome of the cathedral, and churches of San Lorenzo and Spirito Santo, all in Florence. With Alberti he was the pioneer of Italian Renaissance.

Brunet, JACQUES CHARLES, 1780–1867. French bibliographer. *Manuel du Libraire*, 1810 and later.

Brunet-Debaines, LOUIS ALFRED, b. 1845. Etcher of the modern French school. His work from nature is characterized by a thorough knowledge of light and shade, and the value of cast shadows. His reproductions from paintings are among the finest of modern times.

Brunetière, FERDINAND, b. 1849. French critic.

Bruni, LEONARDO. See ARETINUS.

Bruniaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 10 genera and ab. 45 species growing in s. Africa, especially near the Cape of Good Hope.

Brünn. City of Austria, at junction of the Schwarza and the Zwittawa, 90 m. n. of Vienna; capital of Moravia. Pop., 1891, 95,342.

Brunn, HEINRICH, 1822–1894. Prof. of Archæology Univ. Munich from 1865. *Hist. Greek Art*, 1853–59.

Bruno (called THE GREAT), 925–965. Abp. of Cologne 953; chancellor of the empire, and brother of Otho I.

Bruno, GIORDANO, 1548–1600. Italian philosopher; Dominican monk 1563–76. He embraced pantheistic opinions, spent some years in Switzerland, France, England and Germany, rashly returned to Italy 1592, was charged with heresy, imprisoned seven years at Rome, and burned. His statue was erected there 1889, and his works in Latin and Italian have lately been collected.

Bruno, ST., OF COLOGNE, ab. 1030–1101. Founder of the Carthusian order 1084; canonized 1628.

Bruno, ST., OF MAGDEBURG, ab. 970–1009. Benedictine monk, missionary to the pagan Prussians and Slavs, who killed him and 18 others.

Brunswick. State of the German Empire; included in Saxony under the Carlovingians; made a duchy with Lüneburg 1235. Area 1,425 sq. m.; pop., 1890, 403,788. Its capital, Brunswick, on the Ocker, is an ancient city, with some manufactures and a large trade. Pop., 1890, 101,047.

Brusch, GASPARD, 1518–1559. German poet and historian.

Brush. (1) Luminous appearance seen on the projecting parts of the conductors of a powerful electric machine when the latter is worked under favorable conditions in the dark; due to a continuous discharge of electrification into the air, and often consisting of a short foot-stalk with many rays diverging from it like a fan. Positive discharges give larger brushes than negative. (2) Bunch of straight copper wires or flat strips laid parallel and soldered together at one end, which is made to press against the commutator or collector of a dynamo-electric machine in order to lead away the current to the main circuit. Instead of copper, solid pieces of carbon are often used.

Brush, GEORGE DE FOREST, b. 1855. American subject and figure painter. At the Chicago Fair were seen his *Sculptor and King*, *Indian and Lily*, and others.

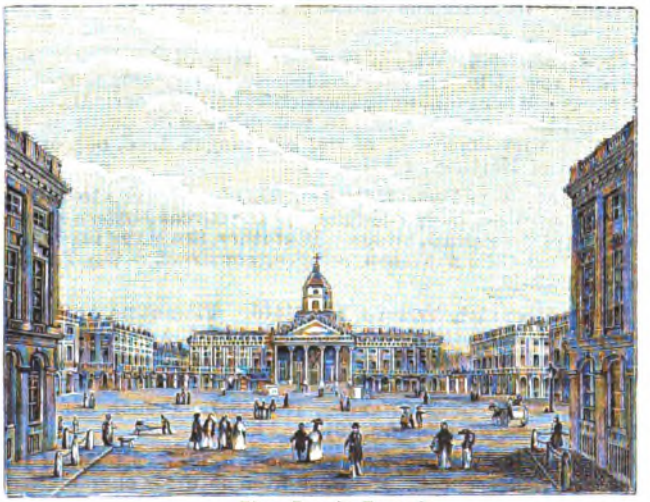
Brush, GEORGE JARVIS, b. 1831. Prof. Yale since 1857; author of a *Manual of Determinative Mineralogy*, 1875.

Brush-Grass. *Andropogon Gryllus.* Native of s. Europe. Its stiff roots are used in the manufacture of brushes.

Brushite. Natural hydrous calcium phosphate, found with guano on islands in the Caribbean Sea.

Brusoni, GIROLAMO, 1610–ab.1680. Italian poet and historian.

Brussels. Capital of Belgium, near the Senne; long noted



Place Royale, Brussels.

for its manufactures of laces. Though ancient, its importance dates from ab. 1500. Pop., 1891, 182,305.

Brussels Conference. Held 1874 by powers of Europe, to consider a code on usages of war. On some points no agreement was reached.

Brussels Museum. In Palais des Beaux Arts. Contains about 600 pictures, and has in recent years grown to importance. It is strongest in works of the Dutch and Flemings.

Brussels Sprouts. Modification of the Cabbage Plant, *Brassica oleracea*, esteemed as a garden vegetable.

Brussels, TREATY OF. Signed July 16, 1863, by all the naval powers, for buying up the toll levied by king of Netherlands on vessels navigating the Scheldt. See LONDON, TREATY OF.

Bruta. See EDENTATA.

Brutus, LUCIUS JUNIUS. Legendary patriot, who roused the Romans to expel the Tarquins, 500 B.C., and put to death his two sons who attempted to restore them.

Brutus, MARCUS JUNIUS, 85–42 B.C. Tyrannicide, nephew and son-in-law of Cato. He sided with Pompey in the Civil War, 49 B.C., was pardoned by Cæsar, made gov. of Cisalpine Gaul 46, and prætor 44; with Cassius he slew Cæsar, opposed the forces of Octavius and Antony, and was defeated.

Bruun, MALTHE CONRAD, 1775–1826. Danish geographer, exiled and lived in Paris.

Bryaceæ. Order of mosses, comprising most of the common species.

Bryant, GRIDLEY, 1798–1867. Civil engineer. He built the first U. S. railway track at Quincy, Mass., 1826.

Bryant, JACOB, 1715–1804. English antiquarian. *Mythology*, 1774; *Philo-Judæus*, 1797.

Bryant, WILLIAM CULLEN, 1794–1878. American poet, noted for his fine descriptions of nature. His *Thanatopsis* was written at 18. *The Ages*, 1821. Ed. N. Y. *Evening Post* from 1828. The centenary of his birth was observed at Cummington, Mass., Aug. 16, 1894.

Bryce, JAMES, b. 1838, at Belfast. Prof. at Oxford, 1870; M. P. 1880; member of Gladstone's cabinet 1892. *Holy Roman Empire*, 1864; *Transcaucasia and Ararat*, 1877; *The American Commonwealth*, 1888. The last is without a rival in its field.

Brydges, SIR SAMUEL EGERTON, 1762–1837. English poet and essayist. Established the Lee Priory Press and made reprints of Elizabethan literature. *Censura Literaria*, 10 vols., 1805–09. *Autobiography*, 1834.

Bryennios, PHILOTHEOS, D.D., b. 1833. Prof. at Chalce 1861, Bp. of Serræ 1875, metropolitan of Nicomedia 1877; discoverer at Constantinople 1873 of the *Didache*, or *Teaching of the 12 Apostles*, which he pub. 1883.

Bryennius, NICEPHORUS. d. ab. 1137. Byzantine historian, son-in-law and officer of Alexius Comnenus.

Bryn Mawr College, PA. Founded 1879 by J. W. Taylor, M.D., for the higher education of women. It has a high standard of admission, and offers graduate courses, with ten fellowships. Students, ab. 250; vols. in library 22,500.

Bryology. Study of *Bryophyta* or *Muscinicæ*, which include two classes, *Hepaticæ* or Liverworts, and *Musci* or Mosses.

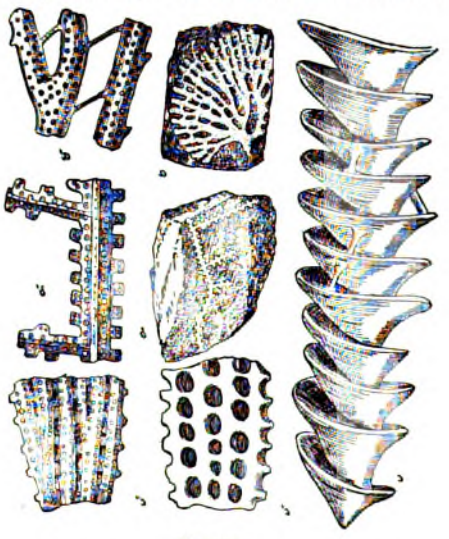
Bryony. *Bryonia dioica.* European vine of the Gourd family, having showy berries and large fleshy roots.

Bryony, BLACK. *Tamus communis.* Vine of the Yam family, native of Europe.

Bryophyta. Subkingdom of plants comprising the Mosses (*Musci*), Liverworts (*Hepaticæ*) and Bog-mosses (*Sphagna*). They are plants of low stature, contain no woody tissue, and are mainly terrestrial in habit. Also known as Anogens and *Muscineæ*.

Bryopsidaceæ. Family of marine Algæ.

Bryozoa (POLYZOA). Small *Molluscoidea*, that form moss-



Bryozoa.

like colonies, with horny or calcareous exoskeleton. Each zoöid (zoœcium) consists of a cell (cystid) in which a polypid

lives, and into which it can withdraw. The polypid has a crown of ciliated tentacles about the mouth. The digestive tract is horse-shoe shaped, the mouth and anus being separated by little more than the ganglion; it is attached below by a reproductive cord (funiculus). Some colonies are polymorphic, having differentiated avicularia, vibracula and oœcia, besides the ordinary zoöids. They are hermaphrodite; but asexual reproduction by budding (which begins in the larva) and by statoblasts is more frequent. There are two orders; the *Endoprocta* and *Ectoprocta*. These are classed as *Eupolyzoa* and made equivalent to two other sub-groups of *Polyzoa;* viz., *Vermiformia* (*Phoronis*) and *Pterobranchia* (*Rhabdopleura*). See ASPIDOPHORA. The *Bryozoa* abound in the fossil state.

Bubastis. Site of an ancient Egyptian city in the Delta, situated on the Pelusiac branch of the Nile. Excavations have been made here in recent years by Edward Naville, especially important for discoveries of statuary of the Hykso period, and for temple ruins of the XIIth Dynasty.

Bubastis. Egyptian goddess, daughter of Isis; represented with head of cat.

Bubble. Small, spherical pellicle of any liquid distended with some gas. In soap-bubbles the pellicle is about $\frac{1}{2000000}$ of an inch in thickness, and that of water about $\frac{1}{10000000}$ of an inch. Castile soap-suds and glycerine make good bubbles.

Bubo. Enlarged lymphatic gland, especially one in the groin, caused by venereal disease.

Buccal. Pertaining to the mouth.

Buccal Funnel. Mastax of Rotifers.

Buccal Mass. Pharynx, odontophore, etc., of Molluscs.

Buccal Openings, or FISSURES. In *Coleoptera*, posterior prolongations of the mouth cavity on each side of the mentum.

Buccal Sutures, or GULAR SUTURES. Lines that run back from the buccal fissures in *Coleoptera*.

Buccaneers. Piratical adventurers, mainly French and English, who maintained themselves in the Caribbean Sea in 16th and 17th centuries, preying on the Spanish settlements and fleets. Tortuga Island was their chief haunt. Morgan, Davis, and Montbars were prominent leaders; their most famous exploit was the capture of Panama.

Buccina. Ancient trumpet, modeled after a shell; sometimes straight, sometimes curved.

Buccinum. See RHACHIGLOSSA.

Bucentaur. Barge of Venetian doge, used 1177–1797 for the annual ceremony of marrying the Adriatic with a ring.

Bucephalus. Favorite horse of Alexander the Great.

Bucer, or KUHHORN, MARTIN, 1491–1551. German reformer, prof. at Strassburg 1524, and at Cambridge 1549. At first a Zwinglian, he accepted Luther's doctrines. His bones were exhumed and burned under Mary 1557.

Buceros. See LEVIROSTRES.

Buch, LEOPOLD VON, 1774–1853. German geologist, who added much to our knowledge of volcanoes by his Theory of Craters of Elevation. The idea of chronomorphosis of genera, first developed by him, gave a great impulse to the study of stratified rocks.

Buchan, ALEXANDER, b. ab. 1820. Scottish meteorologist, author of B.'s Law, announced 1865: "Stand with your left hand toward the center of low barometer and your right hand toward the high, and in the northern hemisphere the wind will be on your back;" often confounded with BUYS-BALLOT'S LAW (q.v).

Buchanan, CLAUDIUS, D.D., 1766–1815. Prof. Bengal 1799–1807. *Christian Researches in Asia*, 1811.

Buchanan, FRANKLIN, 1800–1874. Admiral C. S. N.; commander of the *Merrimac*, which sunk the *Cumberland* and *Congress* in Hampton Roads, March 8, 1862.

Buchanan, GEORGE, 1506–1582. Scottish scholar, tutor of Mary Stuart 1562, and of James VI. 1570, though a vehement Protestant. Latin version of the Psalms, 1570; *History of Scotland*, 1582; *Autobiography*, 1608.

Buchanan, JAMES, 1791–1868. Fifteenth Pres. U. S. M. C. 1820–30; envoy to Russia 1831, and negotiator of a treaty; U. S. Senator 1834–45; Sec. of State 1845–49; minister to England 1853–56; Pres. 1857–61. In Dec. 1860 he denied his official right to resist secession, to which members of his cabinet had contributed.

Buchanan, ROBERT WILLIAMS, b. 1841. Scottish poet and novelist, settled in London 1860. *Undertones*, 1863; *Book of Orm*, 1870; *Shadow of the Sword*, 1876; *Master of the Mine*, 1885.

Bucharest. Capital of Roumania, on the Dimbovitza, a tributary of the Danube; founded in the 13th century. A treaty between Russia and Turkey was signed here May 28, 1812, the Pruth to be the boundary. Pop. ab. 250,000.

Buchner, FRIEDRICH KARL CHRISTIAN LUDWIG, b. 1824. German materialist, author of *Force and Matter*, 1854; *Physiological Pictures*, 1861; *Darwin*, 1868; *Man*, 1869, tr. 1872.

Buchtel College. Founded by Universalists at Akron, O., 1872. It includes normal and preparatory departments, has 11 instructors, and ab. 275 students of both sexes.

Buchu. Shrubs of the genus *Barosma*, natural family *Rutaceæ*, natives of S. Africa; the leaves are said to form the basis of a patent medicine, and are highly esteemed by the natives.

Buck, DUDLEY, b. 1839. Organist in Brooklyn; composer of three cantatas, *The Golden Legend*, 1880; *Voyage of Columbus*, 1885; *Light of Asia*, 1886; songs, an opera, *Deseret*, 1882, and much ch. music.

Buck Bean. *Menyanthes trifoliata*. Bog plant of the Gentian family, native in northern hemisphere.

Buckeye. Trees and shrubs of genus *Æsculus*, of Horse-chestnut family, natives of the U. S.

Buckingham, GEORGE VILLIERS, DUKE OF, 1592–1628. Favorite of James I. of England; admiral 1616; premier to Charles I. A career of tyranny and misgovernment was cut short by his murder.—His son and namesake, 1627-1688, minister of Charles II., wrote *The Rehearsal*, 1671, and other plays.

Buckingham, WILLIAM ALFRED, 1804–1875. Gov. of Conn. 1858–66; U. S. Senator 1869–75.

Menyanthes trifoliata.

Buckland, WILLIAM, D.D., F.R.S., 1784–1856. Canon of Christ Ch., Oxford, 1825; Dean of Westminster 1845. *Reliquiæ Diluvianæ*, 1823; *Geology and Mineralogy*, Bridgewater Treatise, 1836.—His son, FRANCIS TREVELYAN, 1826–1880, was an eminent pisciculturist.

Buckle, HENRY THOMAS, 1822–1862. English author. His *History of Civilization in England*, 1857–61, though but a fragment of what he had in view and full of faults, is a powerful and suggestive book.

Buckle Plates. Wrought-iron plates having the central portion bulged out so as to act like an arch when loaded. They are used for the floors of buildings and for roadways of bridges, being supported by iron or steel beams, which in turn are supported by other trusses, or by walls and piers.

Buckles. Metal fastenings for straps or belts, introduced into England to take the place of shoe-strings during the seventeenth century; from that time onward till 1800 extremely fashionable and used more for ornament than use, being made of precious metals and set with diamonds. Modern ornamental buckles confined to women's belts.

Buckley, JAMES MONROE, D.D., LL.D., b. 1836. Ed. N. Y. *Christian Advocate* since 1880. *Supposed Miracles*, 1875; *Faith Healing*, 1892.

Buckling of a Vessel. Deformation caused by longitudinal or other bending, due to weakness of material or to the improper arrangement and position of the plating supports and stiffeners.

Buckminster, JOSEPH STEVENS, D.D., 1784–1812. Pastor in Boston 1804, and one of the first preachers of his time.—His father JOSEPH, D.D., 1751–1812, was also noted for eloquence.

Bucknell University. At Lewisburg, Pa.; incorporated

1846. It has 20 instructors, ab. 350 students in all departments, and a fund of $350,000.

Buckner, SIMON BOLIVAR, b. 1823; General C. S. A.; Gov. of Ky. 1887.

Buckthorn. Shrubs of genus *Rhamnus*, natural family *Rhamnaceæ*, natives of the northern hemisphere.

Buckthorn, SOUTHERN. *Bumelia lycioides.* Large, spiny shrub of natural family *Sapotaceæ*, native of s.e. U. S.

Buckwheat. *Fagopyrum esculentum.* Herb of the Knotweed family, native of n. Asia, widely cultivated for its edible seeds. It is mostly grown as a by-crop on spare patches of land, or where some other crop has failed. It will give a fair crop on heavy cold soils, where the finer cereal grains cannot be successfully raised. It is sown broadcast or in drills about July, so that it will not ripen till cool weather, as the seeds will not fill well in the hot weather of August. It is largely raised for human consumption, but the by-milling products are good food for animals. The straw is of almost no value for fodder. Three varieties are known, common or black, silver-hulled, and Japanese. There were grown in the U. S. in 1890, 12,113,040 bushels, of which N. Y. and Pa. produced more than half. It is somewhat objectionable as a steady article of diet, as exciting various eruptive disorders. In Russia it forms a part of the army ration. It was introduced into America by the Dutch.

Buckwheat (*F. esculentum*): *a*, a flower; *b*, a seed; *c*, a root.

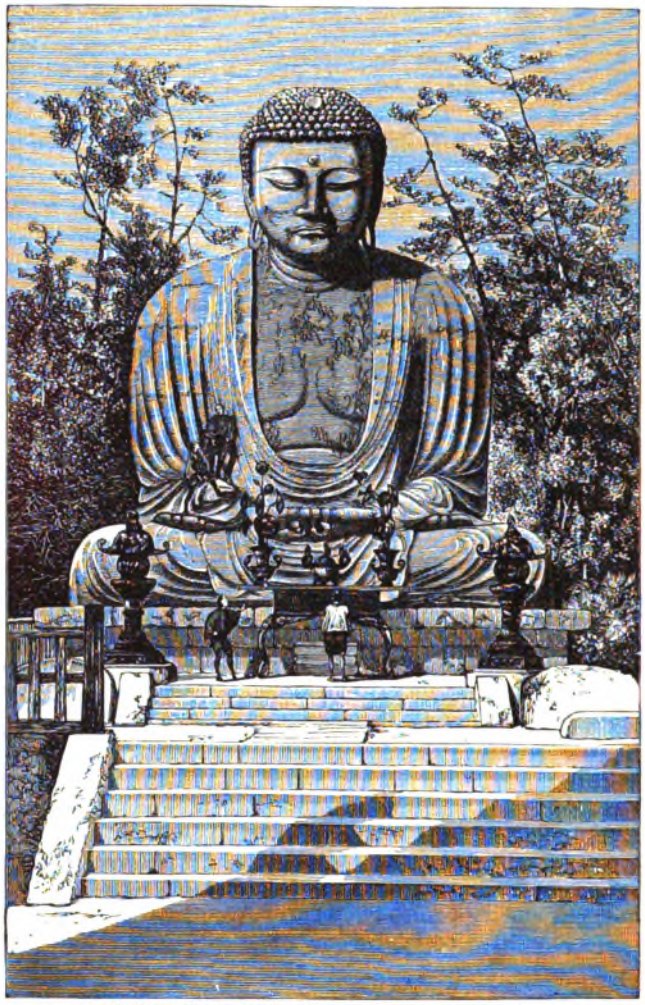
Bud. A vegetable axis in its rudimentary condition, developing either into a stem, a branch, a flower, or a flower cluster. When terminating stems or branches, they are called Terminal; when appearing in the axils of leaves, Axillary; and when borne irregularly, Adventitious Buds.

Buda. Ancient city of Hungary, on right bank of the Danube; taken by Charlemagne 799; sacked by Turks after battle of Mohatz 1526, again in 1541; regained by Imperialists 1686; stormed by Hungarians May 20, 1849. United with Pesth on the other side of the river, it became capital of Hungary Nov. 1873. The new city, Budapest, has made remarkable gains in 20 years. Pop. of the two towns in 1848 less than 148,000; pop., in 1890, 506,091. B. is the most important grain mart of the Austrian Empire. Many improvements in flour-milling originated here.

Buddeus, JOHANN FRANZ, 1667–1729. Prof. at Halle 1693, and Jena 1705. He wrote Latin *Institutions of Moral and Dogmatic Theology*, 1721–28, and a *History* of the same, 1723.

Buddha, GOTAMA, ab. 500–ab. 420 B.C. Of the Sakya tribe, settled ab. 100 miles n. e. of Benares. His mother died in his infancy, and her sister brought him up. He abandoned wife and son at the age of 29 to work out his religious ideas. Failing to find what he wanted in the systems of the famous teachers with whom he studied, he next practiced extreme austerities for two or three years, but finally abandoned this road to deliverance, whereupon his disciples left him in displeasure. Then came the mental crisis when for a day and a night he sat under the Bo Tree and the vision came clothing him with the quality of perfect wisdom and revealing the doctrine he should teach. His disciples had gone to Benares; he followed them there, unfolded his system, and sent them out to proselytize. For the 45 remaining years of his life he preached throughout the Ganges Valley with marvelous effect, and is even said to have visited Ceylon.

Buddhism. Religion of more than half the human race. Its present strongholds are Ceylon, Burmah, Siam, Farther India, Tonquin, Java, Nepaul, Thibet, China, Mongolia, and Japan. India, the cradle of the creed, saw Buddhism degenerate into gross idolatry and finally become extirpated by the Brahmans after sanguinary struggles ab. 600 A. D. It is atheistic in that it ignores any mode of personal existence compatible with the idea of spiritual perfection, but it assumes that the same condition awaits the emancipated soul as is enjoyed by the Supreme Mind. This NIRVANA (q.v.), or Perfect Rest, is the Highest Good. The basis of Buddhism is sorrow. The Four Truths are: 1. The reality of misery. 2. Its cause or accumulation. 3. The possibility of its destruction. 4. The way, or requisite means. The way has 8 stages: Right views, aims, speech, conduct, effort, means of livelihood, mindfulness, and rapture. Along the way there are ten fetters to be broken, and to live according to the 8 stages and to have broken all these fetters constitute the Buddhist ideal of life.


Colossal Statue of Buddha at Kamakoura, Japan.

Budding. Peculiar propagative process of forming new cells, obtaining in the *Saccharomycetes* and certain other fungi; also called sprouting. More commonly, the appearance of buds on flowering plants.

Buddle. Ore-dressing machine in which separation is affected by the flowing of slime in thin sheets over a smooth inclined surface. Many different styles are in use, some of which are stationary and some rotary, some circular and some rectangular.

Budget. Annual statement of receipts and expenditures of governments. Orig., bag containing papers and documents relating to the financial exhibit laid before House of Commons by Chancellor of the Exchequer. France has adopted the term. While the fiscal year varies greatly in different countries, beginning with the calendar year in France, April 1 in Great Britain, and July 1 in the U. S., there is a uniform usage by these and other governments to present the budget to the legislative body at the beginning of each annual session. When presenting it, the finance minister often explains it; in other cases these explanations are made before a committee appointed to receive it. In the U. S. a statement of the annual receipts and expenditures has been laid before Congress by the Sec. of the Treasury since 1790. A Committee of Ways and Means to consider and report on the statement for supplies in administering the Government was constituted by the first Congress 1789, consisting of one member from each State. In 1795 this was made a standing or permanent committee of the House. Its membership was reduced to seven 1802, increased to eight 1863, to eleven 1873, and to thirteen 1879.

Buell, DON CARLOS, U. S. A., b. 1818. Commanding in Ky. and Tenn. 1862; engaged at Perryville Oct. 8. He left the service 1864.

Buena Vista. In Mexico, 7 m. s. of Saltillo; scene of a battle, Feb. 22–23, 1847, between Santa Anna and Gen. Taylor. The former retreated with loss of ab. 2,000; American loss 750.

Buenos Ayres. Seaport, capital of Argentine Republic, on s. shore of the estuary of the Rio de la Plata; founded 1535.

Congress Buildings, Buenos Ayres.

It has a very large trade and commerce, particularly in beef and hides. Pop., 1892, 549,307.

Buffalo. See BOVIDÆ and BISON.

Buffalo. Capital of Erie co., N. Y., on e. end of Lake Erie, at head of Niagara R. It is intersected by 8 railroads, has an extensive lake commerce and large manufacturing interests, particularly of iron and steel, lumber and clothing. Pop., 1890, 255,664.

Buffalo-Berry. *Shepherdia argentea.* Silvery-leaved shrub of natural family *Eleagnaceæ*, native of the n. w. U. S., bearing an edible, acid, berry-like fruit.

Buffalo-Grass. *Bulbilis dactyloides.* Small, wiry grass of the plains of central N. America.

Buffalo-Nut. *Pyrularia pubera.* Shrub of the natural family *Santalaceæ*, native of the southern Alleganies; also called Oil-nut.

Buffer. Plate at the end of a railway-car, which receives the shock of another car by striking a similar plate, each plate transferring the shock to springs, so that the cars themselves may be subject only to a small concussion; sometimes the draw-bar of a car.

Buffon, GEORGES LOUIS LECLERC, COMTE DE, 1707–1788. French naturalist, academician 1753, ennobled 1776. He attempted to cover the whole range of science in *Natural History*, 36 vols., 1749–89, having in part of these the aid of Daubenton and others. His best work is found in vol. 34, *Epochs of Nature*, 1789.

Bufo. See OXYDACTYLIA and BUFONIDÆ.

Bufonidæ (TOADS). Of *Bufo* alone there are 77 species. A Mexican species rivals the bullfrog in size and grows to a length of 8 inches. The eggs of toads are black, and are laid in a single string of jelly. The young tadpoles that develop from them are black. They soon, while small, undergo the metamorphoses that fit them for a terrestrial life; the gills and tail are absorbed, and legs appear. They travel far away overland, hiding in the daytime. When it rains they come out in large numbers. *Alytes obstetricans*, the Obstetric Toad, belongs to an allied family (*Discoglossidæ*). The male winds the egg-string about his thighs, and carries it until they hatch. For the Spade-foot, see PELOBATIDÆ.

Bufoniformia. See OXYDACTYLIA.

Buford, JOHN, U. S. A., 1825–1863. General of cavalry in the Civil War.—His half-brother, NAPOLEON BONAPARTE, 1807–1883, served in the West as gen. U. S. Vols., 1861–65.

Bugbane. Species of *Cimicifuga*, tall shrubs of natural family *Ranunculaceæ*, natives of the northern hemisphere; known also as Bugwort.

Bugbane, FALSE. *Trautvetteria Carolinensis.* Plant of the Buttercup family, native of the s. Alleganies.

Bugeaud, THOMAS ROBERT, 1784–1849. Marshal of France, 1831, gov. of Algiers 1840–48; Duc d'Isly 1844.

Bugenhagen, JOHANN, called DR. POMERANUS, 1485–1558. German reformer, associate of Luther. *Commentary on the Psalms*, 1524.

Bugge, ELSENS SOPHUS, b. 1833. Prof. Christiania 1866; Ed. Norse ballads 1858, sagas, 1864–73, and *Edda*, 1867. *Origin of Northern Mythology*, 1881–89.

Buggy. Small wagon used in coal-mines for carrying coal short distances.

Bugleweed. *Lycopus Virginicus.* Plant of the Mint family, native of e. U. S.

Bugloss. *Lycopsis arvensis.* Plant of the Borage family, native of Europe, but introduced into America.

Bugloss, VIPERS. See BLUEWEED.

Bugs. See HEMIPTERA. This term is often wrongly used to designate beetles and other insects.

Bug-Seed. *Corispermum hyssopifolium.* Plant of the Goosefoot family, native of the northern hemisphere.

Buhl. Cabinet work inlaid with brass in ornamental patterns, so called from its inventor, Charles André Boule, 1642–1732.

Buhrstone, or BURRSTONE. Hard, siliceous rock from which mill-stones are made. Its peculiar vesicular texture keeps the surface from wearing smooth. The best quality comes from France. In recent years iron rollers have come largely into use in flour-mills, and the buhrstone industry has been steadily decreasing in importance.

Building and Loan Associations. Coöperative organizations which collect periodical payments from their members, and loan from the accumulated fund to members on their real estate, with a view to enable persons with small capital to own their homes.

Building Stone. Granite, marble, limestone, and sandstone are the kinds commonly used, being durable, permanent in color, strong, and cheap. The most porous stones are the least durable, as they absorb water and are liable to become disintegrated by frost. It is best that stones should be laid on their "quarry beds," that is, in the same position as in the quarry. Granite is the strongest, but it is liable to crack under the action of fire. The best test of stone is its durability under conditions of actual service.

Bulbs. Buds with fleshy scales. They are generally subterranean, but occur occasionally in the axils of leaves, as in certain Lilies, and are then sometimes called Bulblets or Bulbils.

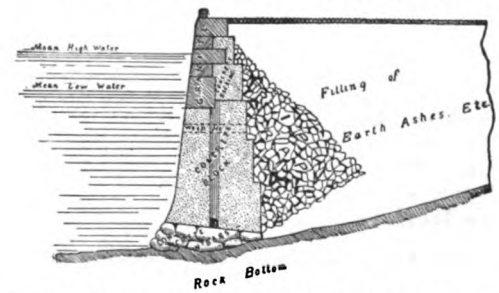
Bulbus. Enlarged base of the stipe of certain toadstools.

Bulbus Arteriosus, or BULBUS AORTÆ. Synangium of the frog's heart; part of the aorta next the heart. In fishes it is often contractile, like the ventricle. When a conus arteriosus is simultaneously present the two together are termed the truncus arteriosus, of which the conus lies between the heart and the bulbus.

Bulgaria. Principality of s. e. Europe, s. of Roumania, e. of Servia. Finnish invaders from the Volga set up a kingdom ab. 680, which was overthrown by Byzantines 1018, re-established 1186, and conquered by Turks 1388–93. The insurrection of 1876 led to practical independence 1878. Alexander of Battenberg, elected Prince 1879, abdicated 1886; Ferdinand of Saxony succeeded 1887. War with Servia 1885 led to the nominal annexation of E. Rumelia. Area of B. proper, 24,500 sq. m.; pop., 1893, 2,313,072. Capital, Sofia. Area of E. Rumelia, 13,160 sq. m.; pop., 1893, 992,386.

Bulgarin, FADDEI VENEDIKTOVITCH, 1789–1859. Russian journalist and novelist. *Demetrius*, 1830; *Mazeppa*, 1832; *Russia*, 6 vols., 1836; *Memoirs*, 6 vols., 1844–49.

Bulkhead. Stone or timber construction forming the facing of a dock. Granite or concrete walls resting on pile foundations are often employed, particularly in Europe. The cut shows a form adopted by the department of docks in New York



Bulkhead Construction on Rock, North River, N. Y. City.

City.—Bulkheads, in naval construction, are very important and numerous, and are fitted with water-tight doors and covers. They are classified as longitudinal, middle-line, partial, transverse, and wing-passage.

Bull. Decree of the Pope as sovereign, "fulminated" on solemn occasions. Orig., seal, thence edict of a secular ruler, as the "Golden Bull" of Andrew II. of Hungary, 1222, and that of Charles IV. of Germany, 1356, as to the election of Emperors.

Bull, GEORGE, D.D., 1634–1710. Bp. of St. David's 1705.

Latin *Defense of the Nicene Faith*, 1680. Collected works, 7 vols., 1827.

Bull, JOHN, ab. 1563–1628. Doctor of music, organist of the Chapel Royal. See GOD SAVE THE QUEEN.

Bull, OLE BORNEMANN, 1810–1880. Norwegian violinist, famous from 1835; resident in the U. S. 1852-57, and largely from 1867.

Bulla. See TECTIBRANCHIATA.

Bullace. *Prunus insititia.* Spiny shrub of the Plum family, occasionally introduced from England into N. America.

Bulla Ossea. See ANATINÆ.

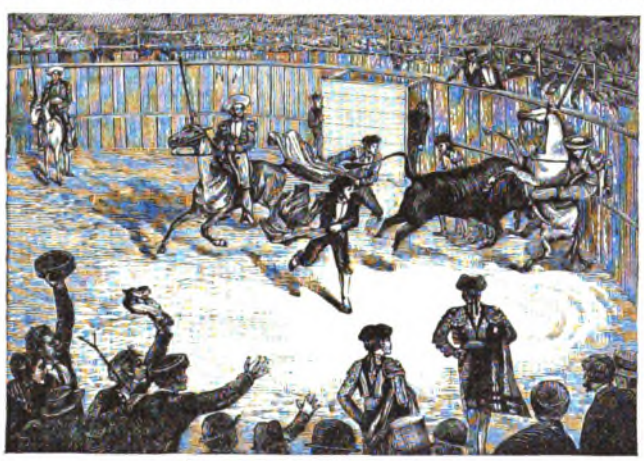
Bullate. Surface of leaves or other organs which are puckered up by the expansion of the parenchyma between the veins.

Bull-Baiting. Sport once common in England, in which dogs were set upon a bull, which was sometimes made more furious by having his nose blown full of pepper before being turned loose. Or the bull was fastened to a stake by a short rope, and bull-dogs, trained to seize him by the nose, were set on him one by one.

Bulldozers. Orig., "Regulators" in La. 1876, who intimidated negro voters with the bull-whip; similar to "Ku-klux" and "White-caps."

Bullet-Proof Cloth. For shields has been popularly experimented with during the past two years. Wire or thin steel is supposed to provide the resistance to penetration. Paper-pulp and aluminium are also used. The coat employed weighs from 9 to 12 pounds, the cloth being about 2 inches thick. Experimental bullet-proof coats or shields have been presented by Boyton, Dowe, Lennard, Lucas, Loris, Manard, Maxim, Smith, Weber and Zeitung.

Bull-Fighting. Popular amusement in Spain; also practiced in Portugal, s. France, and Spanish-American countries. It appears to have been an inheritance from the Moors,



Spanish Bull-fight at San Roque.

and to have been originally an exhibition of horsemanship in which the nobles took part. It exists in Spain as a game, the score of which is the record of horses killed by the bulls and the points made by the matador, or bull-fighter, and his troop. The latter travel from city to city, in most of which are special amphitheaters, Plaza de Toros.

Bullinger, HEINRICH. 1504–1575. Swiss reformer; pastor at Zurich 1531, succeeding Zwingli. He wrote the Second Helvetic Confession, 1566, and exerted much influence on England through the exiles of Mary's reign, and by his sermons, tr. 1577.

Bullion. Uncoined gold or silver, known also as bar-silver and gold bar.

Bullion Report. Made to the English Parliament 1810, by a committee appointed to investigate the currency. The principles then laid down have been the basis of almost all subsequent British monetary legislation.

Bull Pump. Direct single-acting pump, used in vertical mine shafts or steep inclines, in which the pump rods are attached directly to the steam piston. The weight of the rods makes the down stroke.

Bull Roarer. Long, thin, narrow piece of wood, swung by a string attached to one end, so that a loud and peculiar noise is produced. It is a common plaything among children, and is used in religious rites by many savage tribes.

Bull Run, VA., BATTLES OF. July 21, 1861, and August 30, 1862. Union defeats.

Bulls and Bears. In the Stock Exchange, dealers who labor to advance the price of securities are called Bulls, and to depress, Bears.

Bully Tree. *Bumelia nigra.* Large West Indian tree of the Custard-apple family, bearing edible fruits.

Bülow, FRIEDRICH WILHELM VON, 1755–1816. Prussian general, prominent at Leipzig, Waterloo and earlier battles with the French; made Count of Dennewitz 1814.

Bulow, HANS VON, 1830–1894. German pianist, critic and conductor; Prof. Berlin 1855, Chapelmaster at Munich 1867; one of the earliest and stanchest advocates of Wagner's dramas. He visited the U. S. in 1875, 1889 and 1890. His mind was analytical rather than creative, and his compositions have not won popularity.

Buloz, FRANÇOIS, 1803–1877. Swiss-French author and translator, founder of the *Revue des deux Mondes*, 1831.

Bulrush. Large, coarse sedges of genus *Scirpus*, of wide geographical distribution; also called Club-rush. The Bulrush of the Nile is *Cyperus Papyrus*, a large plant of the Sedge family.

Bulrush:
A, Common Cat's-tail (*Typha latifolia*); B, Common Bulrush (*Scirpus lacustris*).

Bulwer, EDWARD GEORGE. See LYTTON.

Bulwer, SIR WILLIAM HENRY LYTTON EARLE, 1801–1872. Brother of Lord Lytton; M. P. 1830–37, envoy to Spain 1843, U. S. 1849, Tuscany 1852, and Turkey 1858. He negotiated the Clayton-Bulwer treaty 1850, and was made Baron Dalling and Bulwer 1871. He pub. *France*, 1854; *Historical Character*, 1868; *Life of Palmerston*, 1870.

Bumboat. Boat used principally by women to supply ships lying off a port with produce and cheap merchandise.

Bumping Post. Structure placed at the end of a railroad turnout to prevent cars from leaving the track.

Bunce, OLIVER BELL, 1828–1890. American author; ed. *Appleton's Journal*. *Bachelor Bluff*, 1882; *Don't*, 1884.

Bunch-Berry. *Cornus Canadensis.* Low plant of the Dogwood family, native of n. N. America; known also as Dwarf Cornel.

Bunch-Flower. Plants of genus *Melanthium*, natural family *Liliaceæ*, natives of e. N. America.

Bundle-Sheath. In plant anatomy, layer of thin-walled cells surrounding one or more fibro vascular bundles.

Bunion. Enlargement of the bursa at the base of the little or great toes, due to pressure or improperly fitting shoes, causing the toe to bend inward, and, when neglected, inflammation of the joint. It may be cured by apparatus to correct the deformity, but in some cases operation is necessary.

Bunker Hill. Eminence in Charlestown (Boston), Mass., scene of a battle June 17, 1775, won by the British after a desperate conflict, and commemorated by a monument dedicated 1843.

Bunner, HENRY CUYLER, b. 1855. American novelist and poet; ed. *Puck* from its start, 1877. *The Midge*, 1886.

Bunodontia (OMNIVORA). Section of artiodactyl (even-toed) Ungulates, having the grinding teeth furnished with tuberculated crowns. It includes the families *Hippopotamidæ*, *Suidæ*, *Anoplotheridæ*, and *Oreodontidæ*.

Bunodont Teeth. Molars whose crowns support tubercles, as in swine. The tubercles may be few and opposite, as in the Hippopotamus, or alternate, as in Hyopsodus, or irregular and numerous as in the Mastodon.

Bunotheria. Order of the placental Mammals, including the sub-orders *Tæniodonta*, *Mesodonta*, *Insectivora*, *Creodonta*, and *Tillodonta*. They have low cerebral development, the feet are ambulatory and unguiculate, usually with five toes. The articulation of the mandible is transverse; the molar teeth are tuberculated with continuous crests. These forms are sometimes all classed as *Insectivora*, but there is great diversity, and they shade off on the one hand into the Marsupials, and on the other connect with different divergent orders, as the *Carnivora*, *Rodentia*, *Edentata*, and *Lemuridæ*.

Bunsen, CHRISTIAN KARL JOSIAS, BARON VON, Ph.D., D.C.L., 1791–1860. German scholar, of intimate English connections; Prussian minister to Rome 1827–38; to England 1841–54; baron 1858. *Egypt's Place in History*, 5 vols., 1845–57; *Ignatius*, 1847; *Hippolytus*, 1852–53; *God in History*, 1857–58, tr. 1868–70.

Bunsen, ROBERT WILHELM, b. 1811. German chemist, prof. Heidelberg 1851–89; discoverer, with Kirchhoff, of spectrum

Robert W. Bunsen.

analysis. Much of his work has had to do with gases and methods for their analysis.

Bunsen Burner. Devised by Bunsen of Heidelberg, in which air is mixed with the gas before it is burned. The combustion in this case is complete, and there is no deposition of soot and but little light. The gas enters through a small opening in the axis of a tube, while the air enters through two adjustable lateral openings a little below the gas opening. The mixture burns at the end of the larger tube.

Buntlines. Fastened to the foot-rope of a square sail to draw it up to the middle of the yard for furling.

Bunyon, JOHN, 1628–1688. English nonconformist, most renowned of prose allegorists. *Pilgrim's Progress*, Part 1, 1678, Part 2, 1684; *Holy War*, 1682; *Grace Abounding*, 1666; and many minor works. A tinker and Baptist preacher, he was in prison 1660–72 and 1675.

Buonarotti. See MICHELANGELO.

Buononcini, GIOVANNI BATTISTA, b. ab. 1672. Italian musician, once by some regarded as a rival of Handel.

Buoy. Conical or spherical floating body placed in spots dangerous to navigation. Used to mark channels, reefs, shoals, and the position of wrecks; also slipped anchors or cables. They are of various sizes and colors of special signification. Lighted buoys and bell-buoys are also used.

Buoyancy. Force with which a body immersed in a fluid (either liquid or gas), is pushed upward; proportional to the volume of the body and the density of the fluid.

Burân. In Siberia and Russia, storm of snow driven by the wind; corresponding nearly to a blizzard in N. America.

Burbage, RICHARD, ab. 1567–1619. English actor, connected with Shakespeare at Blackfriar's theater.

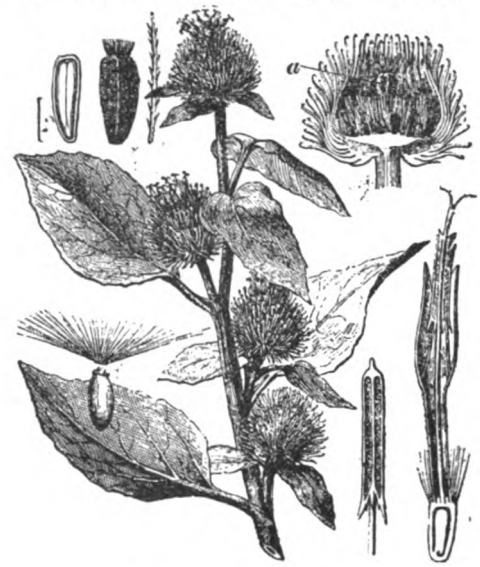
Burckhardt, JOHANN LUDWIG, 1784–1817. Swiss explorer, sent to Africa 1809 by a British society. *Travels in Nubia*, 1819, *Syria*, 1822, and *Arabia*, 1829; *Bedouins and Wahabys*, 1830; *Arabic Proverbs*, 1830.

Burden of Proof. (1) Obligation of a litigant to prove his case, (2) at a given stage of the trial to introduce evidence. In the first sense, it remains throughout the trial on him who has the affirmative of the issue; in the second, it changes from one litigant to the other as the trial progresses, resting at a given moment on him against whom judgment would be rendered if no further evidence were adduced.

Burdette, ROBERT JONES, b. 1844. American humorist, long connected with the Burlington (Ia.) *Hawkeye*.

Burdick, FRANCIS M., LL.B.; b. 1845. Prof. Law, Hamilton Coll. 1882–7; Cornell Univ. 1887–91: Columbia Coll. 1891. *Study of Law as a Part of a General Education*, 1887; *Direct Taxes*, 1889; *Cases on Torts*, 1891.

Burdock. *Arctium Lappa* and other species of *Arctium*. Large-leaved plants of the Composite family, natives of the Old World, introduced as weeds into America. It spreads by means of its hooked burr that clings to the hair and wool of animals, articles of dress, etc. It rarely enters open fields, but adds much to the unsightliness of roadsides and waste places around



Burdock (*Lappa minor*).

dwellings. It is best subdued by spudding out the young plants early in the spring so deeply that they will not start again.

Bürger, GOTTFRIED AUGUST, 1747–1794. German lyric poet. *Lenore*, 1772, and others of his ballads, are of singular force.

Burglary. Breaking and entering another's dwelling-house at night with intent to commit a felony; now generally defined and governed by statute, and often divided into degrees with varying grades of punishment.

Burgon, JOHN WILLIAM, 1813–1888. Dean of Chichester 1876. *Commentary on Gospels*, 1855, and on *Psalms*, 1857; *Lives of 12 Good Men*, 1888.

Burgos. City of n. Spain, founded 844, once capital of Castile. Pop. ab. 32,000. Here were issued in 1512 certain well-meant but ineffective laws for the protection of Indians in the W. Indies.

Burgoyne, JOHN, 1723–1792. British general, who led the invasion of the colonies from Canada 1777, captured Ticonderoga and Ft. Edward, but, becoming detached from his communications, surrendered at Saratoga Oct. 17. He wrote several plays, 1780–86.—His son, SIR JOHN FOX, D.C.L., 1782–1871, won distinction as an engineer in the Peninsular War and in the Crimea, was made lieut.-gen. 1851, baronet 1856, and field-marshal 1868.

Bur-Grass. *Cenchrus tribuloides*. Found especially along the Atlantic coast of U. S. and in sandy places inland.

Burgundy. The Burgundians were Goths who entered Gaul 407. In 451 their king, Gondicar, was defeated and slain by Attila. In 534 they submitted to the Frankish rule. In the 9th century were founded the two kingdoms of Lower and Upper Burgundy, united 10th century in the kingdom of ARLES (q.v.). Rudolf III. left B. to Conrad II. of Germany 1032; Henry III. made it a duchy. Under Philip the Bold, 1363, began its period of greatest power and splendor. After the death of Charles the Bold, B. proper was incorporated with France 1479. It now forms the departments of Cote-d'Or, Saone-et-Loire, Ain, and part of Yonne.

Burgundy Wines. These wines are made in the departments of Cote-d'Or, Sâone-et-Loire, and Yonne, in France, a portion of the old province of Burgundy. There are both red and white wines, and they are noted for their delicacy, fine bouquet, and delicious flavor. Among those grown in Cote-d'Or may be mentioned Chambertin, Clos de Vougeot, Romanée Conti, Nuits, Beaune, Volnay, and Pommard, all red wines. Of the white wines, there are Genevrières, Goutte d'Or, Perrières, Montrachet, the best of white Burgundies, and Gravieres. Macon comes from Sâone-et-Loire and Chablis from Yonne, the former a red, the latter a white wine. The best wines are made from selected grapes, from the best localities and exposures, and with the greatest care in pressing, fermenting, and cellaring. In alcoholic strength they range from 10 per cent in Macon to

13 per cent in Chambertin. Analysis showed no sugar and an acidity in the former equal to 6.8 grs. per oz., and in the latter equal to 4.3 grains of tartaric acid. The acid is probably racemic or malic acid; it is not acetic or tartaric acid.

Burial OF THE DEAD. See DISPOSAL OF THE DEAD.

Burke, EDMUND, LL.D., 1728–1797. Irish philosopher and statesman, famed for eloquence; M. P. 1765. *Inquiry into the Sublime and Beautiful*, 1756; *Revolution in France*, 1790.

Burke, SIR JOHN BERNARD, LL.D., 1815–1892. Genealogist; Ulster king-at-arms from 1853. He edited the *Peerage and Baronetage*, first issued in 1826 by his father, JOHN, 1786–1848. *The Landed Gentry*, 1853.

Burlamaqui, JEAN JACQUES, 1694–1748. Prof. of Ethics and Law in Geneva 1729. *Natural Law*, 1747; *Political Law*, 1751.

Burleigh, WILLIAM CECIL, LORD, 1520–1598. English statesman; Sec. of State 1548, Prime Minister from 1558, Lord Treasurer 1572.

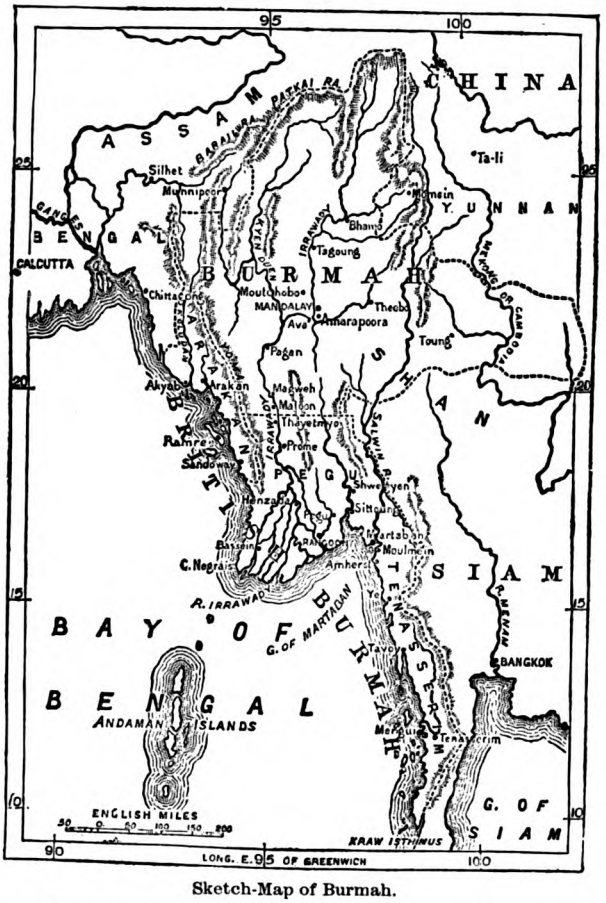
Burlingame, ANSON, LL.D., 1822–1870. M. C. from Mass. 1854–60; Commissioner to China 1861; Chinese Ambassador to U. S. and Europe 1867.

Burlington. City of Des Moines co., Iowa, on w. bank of the Mississippi. Pop., 1890, 22,565.

Burlington. City of Chittenden co., Vermont, on e. shore of Lake Champlain. It has two railroads and the State Univ. Pop., 1890, 14,590.

Burlington. Limestone stratum forming a part of the Lower Carboniferous series in the Mississippi Valley.

Burmah. Country of the Indo-Chinese peninsula, s. of China and e. of India; area ab. 160,000. sq. m. The capital is Mandalay. Ava was ceded to Great Britain 1824, Pegu annexed



Sketch-Map of Burmah.

1830. King Theebaw, of a dynasty founded ab. 1650, was conquered 1885, and most of his dominions added to the Indian Empire 1886. Pop. near 8,000,000.

Burmann, PETER, 1668–1741. Prof. at Utrecht and Leyden. He and his son PETER, 1714–1778, edited many classics.

Burmanniaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Monocotyledones*, comprising 10 genera and ab. 50 species, widely distributed throughout the warmer parts of the globe; commonly called the Burmannia family.

Bur-Marigold. Plants of the genus *Bidens*, natural family *Compositæ*.

Burmeister, KARL HERMANN KONRAD, 1807–1891. Prof. Halle 1837; author of an important work on the organization of Trilobites; keeper from 1861 of the geological museum at Buenos Ayres, where he collected numerous remains of the extinct Pleistocene Mammalia of Argentina.

Burmeister, RICHARD, b. 1860. German composer and pianist, studied with Liszt. Teacher at the Peabody Conservatory, Baltimore 1885. *Pianoforte Concerto*, D minor, 1890; *The Chase After Fortune*, symphonic poem, 1893; *Pianoforte Concerto*, G minor; *Der Blummrache*, cantata.

Burmese, OR BURMANS. Chief inhabitants of Burmah. They are short, but powerful, broad-faced, flat-nosed, with Mongolian eyes and complexion. They tattoo, especially the calves, and wear a single cloth wound about the body. The beard is poorly developed. While polygamy is forbidden by law, concubinage is unlimited. Legally the wife is equal to her husband, and goes about freely, buying and selling. The people are lazy, pleasure-loving, hospitable, but very untruthful. They are Buddhists, indifferent to death and to infanticide or murder. All male children receive religious instruction and can read and write. They welcome European ideas.

Burnaby, FREDERICK GUSTAVUS, 1842–1885. English traveler; lieut.-col. 1880; killed in battle in Africa. *Ride to Khiva*, 1876; *Through Asia Minor*, 1877; *Our Radicals*, 1886.

Burnand, FRANCIS COWLEY, b. 1836. English humorist; ed. *Punch* from 1880. *Happy Thoughts*, 1868.

Burne-Jones, EDWARD, b. 1833. English painter of the æsthetic and romantic schools; in composition and decorative feeling influenced by the early Italians.

Burnet. Plants of genus *Poterium*, natural family *Rosaceæ*, natives of the northern hemisphere.

Burnet, GILBERT, F.R.S., 1643–1715. Historian; prof. Univ. Glasgow 1669; king's chaplain 1674; declined a bishopric, and promoted the Revolution; Bp. of Salisbury 1689. *Reformation Ch. of England*, 3 vols., 1679–81 and 1715; *Exposition of the 39 Articles*, 1699; *History of his own Times*, 1723–34.—His brother THOMAS, M.D., wrote a Latin *Thesaurus of Medical Practice*, 1673.

Burnet, THOMAS, 1635–1715. English scholar. His *Sacred Theory of the Earth*, 1680–89. is a monument of ingenious error. Other works of his anticipate some tenets of modern biblical criticism and liberal theology.

Burnett, MRS. FRANCES ELIZA (HODGSON), b. 1849. Anglo-American novelist. *That Lass o' Lowrie's*, 1877; *Haworth's*, 1879; *Louisiana*, 1880; *A Fair Barbarian*, 1881; *Through One Administration*, 1883; *Little Lord Fauntleroy*, 1886; *Sarah Crewe*, 1888; *The One I Know Best*, 1893.

Poterium sanguisorba.

Burnettizing. Process of impregnating timber with a solution of chloride of zinc, to prevent its decay. It is most frequently used for railroad cross-ties, which can be burnettized at a cost of ab. 25 cents each, their life being thus increased from ab. 8 years to 16. 1½ lbs. chloride of zinc to 12 gals. water are forced into the wood, which absorbs from 5 to 20 lbs. chloride of zinc per 1,000 ft. board measure. Patented by Burnett 1838.

Burney, CHARLES, F.R.S., Mus. D., 1726–1814. English composer; author of a *History of Music*, 4 v., 1776–89, and *Present State of Music*, 3 v., 1772–73.

Burney, FRANCES (MME. D'ARBLAY), 1752–1840. English novelist, married 1793. *Evelissa*, 1778; *Cecilia*, 1782; *Camilla*, 1796; *Diary and Letters*, 7 vols., 1842–46.

Burnham, MRS. CLARA LOUISE (ROOT), b. 1854. American novelist. *No Gentleman*, 1881; *A Sane Lunatic*, 1890; *Dr. Latimer*, 1893; *Sweet Clover*, 1894.

Burning-Bush. *Enonymus atropurpureus.* Shrub of the natural family *Celastraceæ*, native of e. N. America; also known as Waahoo.

Burning-Glass. Lens in which parallel heat rays from

the sun are brought to a focus at the principal heat focus of the lens. The term is also applied to those concave mirrors of quicksilvered glass, or burnished metal, which condense the sun's rays into a similar focus. A passage in Aristophanes' *Clouds* shows that the ancients used the refracting burning-glasses; Pliny and Lactantius also mention them. The burning-mirrors of Archimedes and Proclus are famous: the latter burned the navy of Vitellius, who was besieging Byzantium, and the former set fire to the Roman fleet at the siege of Syracuse. In mediæval and modern days the most notable burning-glasses have been made by Settala, Vilette, Tschirnhausen, Buffon, Trudaine and Parker. The latter fused 10 grains of slate in 2 seconds.

Burnley. Manufacturing borough of Lancashire, on the Brun, 20 m. n. of Manchester. Pop., 1891, 87,058.

Burnouf, EUGENE, 1801–1852. French orientalist, author of valuable studies in Hindu and Persian. *Hist. Buddhism*, 1845.—His father, JEAN LOUIS, and his cousin, EMILE LOUIS, also distinguished themselves by philological researches.

Burns and Scalds. Injuries inflicted by fire, heated bodies, corrosive substances, and hot water or steam, the latter causing scalds, and consisting in the carbonization of the tissues or coagulation of their albuminoids. Death results from the shock, exhaustion of the healing of a large amount of surface, destruction of enough surface to interfere with the excretion by the skin of the waste products of the organism, or ulceration of the stomach or intestines—a phenomenon not well understood. Deforming scars nearly always result, and the principal part of the immediate treatment consists in protecting the parts by oleaginous bodies. Slight burns may be simply covered by cloths dipped in a strong solution of baking soda.

Burns, ANTHONY, ab. 1830–1862. Fugitive slave, whose arrest in Boston, May 25, 1854, caused great excitement.

Burns, JABEZ, D.D., 1805–1876. English Baptist; prolific writer.

Burns, JAMES DRUMMOND, 1823–1864. Scottish sacred poet.

Burns, JOHN, b. 1858. English labor organizer, leader in the London dock strikes of 1889, M. P. 1892. He visited the U. S. 1894.

Burns, ROBERT, 1759–1796. Greatest of Scottish poets, precursor of Wordsworth, and a powerful agent in reforming English taste. His first volume appeared 1786. His poetry has a wide range, lyrical, satirical, humorous, and descriptive, but his songs strike the deepest and truest note.

Burnside, AMBROSE EVERETT, 1824–1881. General of U. S. Vols. 1861–65; defeated at Fredericksburg, Va., Dec. 13, 1862, while commanding Army of the Potomac; Gov. of R. I. 1866–69; U. S. Senator from 1875.

Burnt-Offering. Jewish sacrifice, answering to the holocausts of paganism, the victim being wholly consumed.

Burr, AARON, 1756–1836. U. S. Senator from N. Y. 1791–97, Vice-Pres. 1801–5. He killed Alexander Hamilton in a duel 1804; formed mysterious plans, probably involving an attempt on Texas or Mexico, with the s. w. Territories; was arrested Jan. 1807 in Mississippi, tried for treason at Richmond in May, and acquitted. After years of wandering, he returned to N.Y. 1812, but public life never reopened to him.

Burr, ENOCH FITCH, D.D., b. 1818. Pastor at Lyme, Conn., from 1850. *Ecce Cœlum*, 1867; *Pater Mundi*, 1869; *Ad Fidem*, 1871; *Aleph*, 1891.

Burr, GEORGE LINCOLN, b. 1857. Prof. at Cornell 1892. *Literature of Witchcraft*, 1890; *Charlemagne*, 1892.

Burr, WILLIAM HUBERT, C.E., b. 1851. Prof. of mechanics in Rensselaer Polytechnic Institute 1876–84; prof. civil engineering in Lawrence Scientific School 1891–93, and in Columbia College since 1893. *Roof and Bridge Trusses*, 1879; *Materials of Engineering*, 1883.

Burrage, HENRY SWEETSER, D.D., b. 1837. American author and journalist. *Anabaptists in Switzerland*, 1883; *Baptist Hymn-Writers*, 1888.

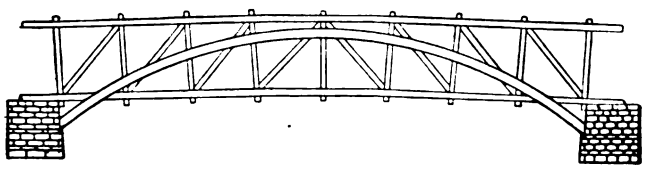
Bur-Reed. Plants of genus *Sparganium*, natives of the northern hemisphere, growing in swamps.

Burrill, ALEXANDER M., 1807–1869. *Practice of Sup. Ct. of N. Y.*, 1840; *Law Dictionary*, 1850; *Assignments*, 1853.

Burritt, ELIHU ("LEARNED BLACKSMITH"), 1811–1879. American lecturer. *Sparks*, 1844; *Chips*, 1878.

Burroughs, JOHN, b. 1837. American author. *Walt Whitman*, 1867; *Wake Robin*, 1871; *Birds and Poets*, 1877; *Fresh Fields*, 1884.

Burr Truss. Wooden bridge-truss, first built 1804 by Theodore Burr, in which the inclined braces take compression and the vertical posts take tension; usually stiffened by an arched



Burr Truss Bridge.

beam. The bridge at Waterford, N. Y., is the oldest wooden structure in the U. S. It has been little built since 1850, iron trusses having taken its place.

Bursa. Small sac, containing fluid, found in many parts of the body, which forms a sort of pad over which muscles and tendons glide.

Bursa Choroidei. Marsupium, or pecten, in the anterior part of the vitreous chamber of the eye of birds.

Bursa Entiana. Swollen sac on the intestine beyond the pylorus in sharks. In higher fishes there is usually a set of cæca at this place.

Bursa Fabricii. Cloacal glands in birds.

Bursa Genitales. Genital pouches into which the eggs of Ophiurians pass on their way from the ovaries to the exterior.

Burseraceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 13 genera and ab. 275 species, distributed throughout the tropical regions of the whole earth.

Burstenbinder, ELIZABETH ("E. WERNER"). German novelist, known in America by Mrs. A. L. Wister's translations. *Banned and Blessed*, 1883; *St. Michael*, 1886; *Alpine Fay*, 1889.

Burton, JOHN HILL, LL.D., 1809–1881. Scottish historian and bibliographer. *Life of Hume*, 1846; *History of Scotland*, 1853–67; *Book-Hunter*, 1862; *Queen Anne's Reign*, 1881.

Burton, SIR RICHARD FRANCIS, 1821–1890. English explorer and author. *Sindh*, 1851; *Medinah and Mecca*, 1856; *Central Africa*, 1860; *Brazil*, 1869; *Zanzibar*, 1872; *The Congo*, 1875; *Midian*, 1878; *Gold Coast*, 1882; tr. *Arabian Nights*, 1885–88, 10 vols.; *Supp. Nights*, 1886–88, 6 vols.

Burton, ROBERT, 1576–1640. English author, famous through his *Anatomy of Melancholy*, 1621.

Burton, WILLIAM EVANS, 1804–1860. Anglo-American actor and manager, eminent in comedy; author of a play, *Ellen Wareham*, 1833, and compiler of a *Cyclopedia of Wit and Humor*, 1858.

Burweed. *Xanthium spinosum.* Coarse, spiny weed of the Composite family, native of s. Europe, but now widely distributed.

Bury. Manufacturing borough of Lancashire, on the Irwell, 9 m. n.w. of Manchester. It contains manufactures of cotton and woolen goods, paper and iron; there are large coal-mines in the vicinity. Pop., 1891, 57,206.

Busaco, PORTUGAL. Scene of Wellington's defeat of the French under Massena, Sept. 27, 1810.

Busby, THOMAS, Mus.D., 1755–1838. English composer; author of a dictionary, grammar and history of music, 1786–1819.

Büsch, JOHANN GEORG, 1728–1800. Teacher at Hamburg. *History of Trade*, 1781.

Büsching, ANTON FRIEDRICH, 1724–1793. German geographer. *Description of the Earth*, 1754; *Magazine of History and Geography*, 25 vols., 1767–93.

Bush, GEORGE, 1796–1859. Prof. Univ. N. Y. 1831–47. *Life of Mohammed*, 1832; *Hebrew Grammar*, 1835; O. T. Commentaries, 8 vols., 1840–48; tr. Swedenborg's diary, 1845.

Bush-Apple. *Achras australis.* Small tree of the natural family *Sapotaceæ*, bearing an edible fruit.

Bush-Brown, H. K., b. 1857. American sculptor. Most important works, the colossal *Indian Buffalo Hunt* shown at the Columbian Exposition and an equestrian statue of *Gen. Meade*, a commission for the State of Pennsylvania, to be placed on the field of Gettysburg.

Bush-Clover. Plants of genus *Lespedeza*, natural family *Leguminosæ*, natives of Asia and N. America.

Bushel. Measure of capacity adopted in England 1826 and in N. Y. 1829, containing 8 gallons and known as the Imperial bushel. It contains 80 lbs. of water (temperature 62° F., barometric pressure 30 in.), or a capacity of 2218.2 cubic inches. The old Winchester bushel, adopted as the U. S. standard, contains 2150.42 cub. in., or 35.327 liters. The weight of a bushel of wheat is fixed at 60 lbs. in most of the States, but the weight of other staples locally varies. Bushel of beans weighs 62 lbs. in N. Y. Wheat, peas, clover-seed, potatoes, 60 lbs., Indian corn, 58 lbs.; rye, 56 lbs.; flax-seed, 55 lbs.; buckwheat, barley, 48 lbs.; timothy-seed, 44 lbs.; oats, 32 lbs.

Bushel. Game played in n. England by two persons, each with three men or pieces, upon a diagram in the form of a square or rectangle, divided into eight equal triangles by intersecting lines. The object is to block the opponent's pieces. Similar games are played by children in e. Asia from Korea to Siam.

Bush-hammered Masonry. Composed of stones dressed with the workman's bush-hammer, so that the surface appears covered with fine points.

Bush-Honeysuckle. *Diervilla trifida.* Shrub of natural family *Caprifoliaceæ*, native of n. e. N. America.

Bushings. In pipe-fitting, device by which a hole in a large fitting can be so reduced as to make it possible to screw in a smaller pipe. In machine construction, ring or cylinder fitted into a hole, which is thus reduced in size and caused to fit a rod or pin which is to work there. The advantages of this construction are that the bushing can be easily and cheaply renewed, as it wears, without necessitating the renewal of the whole organ, which has not worn at all; and, secondly, the bushing can be made of some metal peculiarly adapted to withstand wear. Machinery bushings are made of steel, or of brass or of bronze. Sometimes they are so made that, as they grow larger by wear, the lost motion can be taken up by compression between nuts in a tapering hole.

Bushmen (SAAN). Aborigines of the Cape Colonies of Africa; perhaps originally they covered much of S. Africa. They are spare and short, averaging 4¾ ft. high; those near Lake Ngami are taller. In color they are a clear brown; their hair is sparse, short and coarse. Grease and dirt are used as a covering for the body in place of clothes. They are nomadic and troglodytic, construct no dwellings, except sometimes rude nests in the bushes, whence the name. A few pelts of sheepskin serve for bed-quilt. The only implement is a stone with a hole in it, through which passes a stick, used for digging up roots. Tattooing is not practiced. They eat reptiles and vermin, and go for days without eating, then gormandize for a while. They hunt and war with poisoned arrows, which they shoot with great precision. They have spears, and use them in hunting large game, which they drive into covered pits.

Bushmen's Encampment.

The principal weapon is a club. There are no chiefs; women are courted and mated temporarily, much as among certain monogamous animals. The strongest males secure the finest women, leaving the old women to the boys. They are crafty and cruel, have a gift for music, and ornament their caves with painting. They are passionately fond of dancing, accompanying it with drumming. They believe in magic, and worship the dead. In their language there are no verbs, scarcely nouns, and no way of counting. Words are monosyllabic, guttural and gurgling, with clicks and smacking sounds similar to those made by apes in a menagerie. Each locality or tribe has a fundamentally different language from its neighbors. They are inferior, though related, to the Hottentots, and to be compared with the Australians, who, like them, represent the survivors of primitive races.

Bushnell, DAVID, 1742–1824. American inventor of submarine explosives 1776–78.

Bushnell, HORACE, D.D., LL.D., 1802–1876. New England theologian. *Christian Nurture*, 1847; *God in Christ*, 1849; *Nature and the Supernatural*, 1858; *Vicarious Sacrifice*, 1865; *Forgiveness and Law*, 1874. His influence was in line with that of Maurice and F. W. Robertson, in turning religious thought from a traditional and legal to a moral and spiritual basis.

Bushwhackers. Guerillas and predatory deserters in Mo. and the s. w. 1861–65.

Business Colleges. Institutions where people are fitted to enter upon a business career. Business transactions are made between the students themselves and with the different fictitious departments of the college, such as the college bank, broker's office, etc., so as to familiarize them with the principles and formalities of real business. Students also occupy the different positions in these departments, such as teller, cashier, bookkeeper, etc. Telegraphy, stenography and typewriting are also taught.

Bussu. *Manicaria saccifera.* Palm, native of n. S. America. The leaves are used for thatching huts.

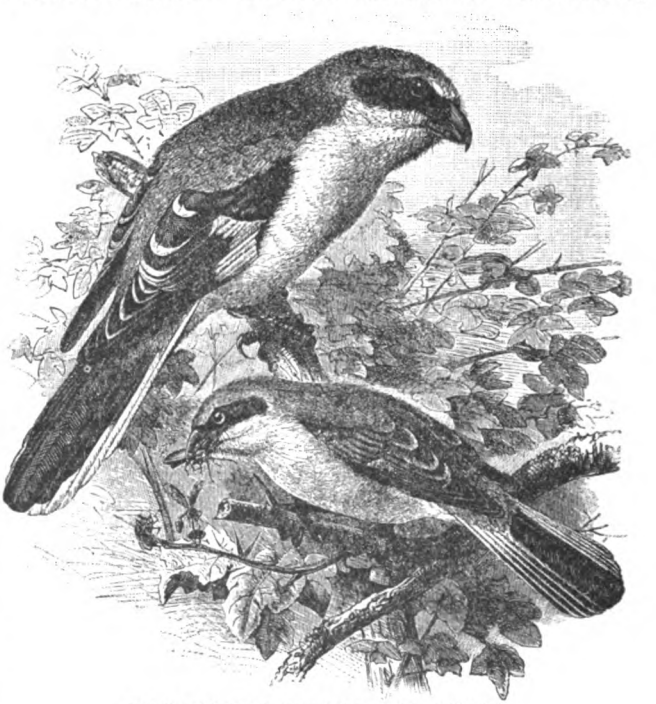
Bussy-Rabutin, ROGER, COUNT DE, 1618–1693. French writer of memoirs. *Histoire Amoureuse des Gaules.*

Bustamente, ANASTASIO, 1780–1853. Vice-pres. of Mexico 1829, pres. 1830–32 and 1837–41; defeated by Santa Anna and banished 1833 and 1842.—His relative, CARLOS MARIA, 1774–1848, pub. books on Iturbide and Santa Anna, and a Hist. Mexican Revolution, 6 v., 1823–32.

Bustards. Birds of the family *Otidæ*, of large size, resembling the American Turkey, and esteemed as much for food. They have rather long, stout legs with three toes, the hind one absent. They run and fly well. Their food is vegetable, gathered on the steppes. They are becoming extinct in many parts of Europe; 35 species have been described from Africa, two occur in Europe, many in Asia, and some in Australia. *Otis tarda* is the Great Bustard of Europe. It has a large pouch of the œsophagus, beneath the chin, which is inflated during the breeding season. *O. tetras* is the Little Bustard of Europe, about as large as the Grouse. *Houbara macqueenii* of western Asia is hunted by means of camels circling round a flock until within shooting-distance. The plumage harmonizes so perfectly with the sand that they are hard to see.

Butane. $CH_3.CH_2.CH_2.CH_3$. Gaseous hydrocarbon of the marsh gas group, occurring in solution in crude petroleum. There are two hydrocarbons of this formula.

Butcher-Birds. Different members of the *Laniidæ*,



Butcher-birds (*L. excubitor* and *L. collurio*).

especially the shrikes of genus *Lanius*. They impale insects, mice, birds, etc., which they have caught for food, upon thorns,

which serve as forks to hold the food while they are tearing off pieces with their bills.

Butene. See BUTYLENE.

Butine. CH_2:CH.CH:CH_2. Bpt. 20° C. Liquid with a low boiling point, at common temperatures a gas. Present in illuminating gas. Unites with bromine to form a crystalline tetrabromide.

Butler, ALBAN, 1711–1773. English R. C. divine, prof. at Douay and pres. St. Omer. His *Lives of the Saints*, 1756–59, were continued by his nephew, CHARLES, 1750–1832, author of *Horæ Biblicæ*, 1797, and *Memoirs of English Catholics*, 1819–21.

Butler, BENJAMIN FRANKLIN, 1818–1893. Mass. lawyer, general of U. S. Volunteers 1861–65; in command at New Orleans 1862; attacked Fort Fisher, N. C., Dec. 1864; M. C. 1867–75 and 1877–79; Gov. of Mass. 1883; Greenback candidate for the Presidency 1884. *Autobiography*, 1892.—Another of this name, 1795–1858, was U. S. Attorney-Gen. 1833–38, law prof. Univ. N. Y., and father of WM. ALLEN B.

Butler, MRS. ELIZABETH SOUTHERDEN (THOMPSON), b. ab. 1844, m. 1877. English painter of military subjects, as *The Roll-Call*, at Windsor Castle, and *Rorke's Drift*, 1881.

Butler, GEORGE BERNARD, N.A. 1873, S.A.A. 1880, b. 1838. American portrait painter.

Butler, JOSEPH, D.C.L., 1692–1752. Bp. of Bristol 1738, of Durham 1750. His *Analogy of Religion*, 1736, has been widely used as a text-book. His *Sermons*, 1726, were called by Dr. Chalmers "the most precious repository of sound ethical principles extant in any language."

Butler, SAMUEL. 1612–1680. English satirical poet, author of *Hudibras*, 1663–78.

Butler, WILLIAM ALLEN, b. 1825. American satirical poet. *Nothing to Wear*, 1857; *Two Millions*, 1858; also a *Life of Van Buren*, 1862.

Butler, WILLIAM ARCHER, 1814–1848. Prof. Trinity Coll., Dublin, 1837. His *Sermons*, 1849–56, and *Ancient Philosophy*, 1856, are highly rhetorical.

Butte City. Capital of Silver Bow co., Montana, center of a rich mining region; settled 1864. Pop., 1890, 10,723.

Butter. Chemically a mixture of triglycerides of fat acids, mainly butyric, capronic, caprylic, and caprinic acids, which are volatile, and myristic, palmitic and stearic acids, which are non-volatile. If milk or cream be agitated at a temperature between 47 and 64° F., the globules of fat will gather into lumps or grains, carrying with them some water and a small amount of the albuminous matter of the milk. If the temperature is too low, butter will not form, because the fat globules are then too hard to stick together; if too high, agitation serves only to break the globules up into still smaller size. Butter of the best quality should be of a golden-yellow color, of granular texture when broken, and of a mild, pleasant characteristic flavor. The moisture in it should be free from milkiness and contain no undissolved salt. Butter should contain about 85 per cent fats, 12 per cent moisture, and 3 per cent ash, salt, casein, etc. It melts at from 92° to 95° F.

Butter-and-Eggs. *Linaria vulgaris.* Yellow-flowered plant of the natural family *Scrophulariaceæ*, native of Europe, but widely diffused as a weed; known also as Toad-flax and Ransted-weed. See SNAPDRAGON.

Buttercup. Large-flowered species of the genus *Ranunculus;* widely distributed group of plants.

Butterfly. See PAPILIONIDÆ and RHOPALOCERA.

Butterfly-Pea. Showy-flowered plants of the genera *Centrosema* and *Clitoria*, natural family *Leguminosæ;* natives of e. America.

Butterfly-Weed. *Asclepias tuberosa.* Red-flowered Milkweed, native of e. N. America; called also Pleurisy Root.

Butterine. Mixture of OLEOMARGARINE (q.v.), neutral lard, and cotton seed oil.

Butter Machines. Recently invented, to separate the cream from the milk and make it into butter at one operation by means of centrifrugal force. They are still in the experimental stage of development. One form is called the butter-extractor, the other, the butter-accumulator.

Buttermilk. Fluid which separates in the process of churning; used extensively as an article of diet; useful in Bright's disease and diabetes, and for infants. It contains ab. 11 per cent of solids, ab. one quarter being lactic acid, which renders it easy of digestion.

Butternut. *Juglans cinerea.* Large tree of the Walnut family, native of e. N. America; also, in British Guiana, *Caryocar nuciferum*, a large tree of the Camellia family, whose seeds are an article of commerce and known also as Souari nuts.

Butter of Antimony. See ANTIMONY TRICHLORIDE.

Butter-Tree. In India, *Bassia butyracea* and *B. latifolia.* Trees of the natural family *Sapotaceæ*, whose seeds yield a thick oil. In w. tropical Africa, *Butyrospermum Parkii* and *Pentadesma butyracea;* in s. e. Africa, *Combretum butyraceum.*

Butterweed. *Senecio lobatus.* Yellow-flowered plant of the natural family *Compositæ*, native of the s.w. States.

Butterwort. Species of the genus *Pinguicula*, small plants of the natural family *Lentibulariaceæ*, widely diffused.

Butterwort (*Pinguicula vulgaris*).

Butterworth, HEZEKIAH, b. 1839. American author, long an editor of the *Youth's Companion. Zigzag Journeys*, 12 v., 1878–90.

Butt-Joint. Formed by two iron or steel plates which butt squarely against another and are connected by one or two cover-plates riveted upon them. It is more efficient than the common lap-joint.

Button, SIR THOMAS. English navigator who sailed to discover the N. W. passage May, 1612, wintered in Hudson's Bay, and explored the coast of Southampton Island.

Button. Studs and buttons were worn as ornaments in the 14th century. In the 16th century, the use of buttons was extended, but they were handmade and expensive. Cloth covered buttons were used early in the 17th century, and inlaid and steel buttons in the 18th century, to be succeeded by gilt buttons. Boulton in 1745 improved the manufacture of these metallic buttons by machinery, and Sanders, early in the present century, made metallic buttons, covered with cloth, his son in 1825 introducing the canvas tuft instead of the metallic shank. Horn buttons were made in 1777. Buttons are now made of a great variety of materials, wood, metal, vulcanized rubber, porcelain, mother-of-pearl, vegetable ivory, etc. In England, Birmingham has the largest trade. France, Germany and Austria by their cheaper labor have become large producers. At Prague, glass and porcelain buttons are largely made. Great ingenuity has been exercised in the machinery by which they are produced. In U. S. Williston made cloth covered buttons at Easthampton, Mass., in 1848. The chief manufactories are in New York and Philadelphia.

Button-Bush. *Cephalanthus occidentalis.* N. American shrub of the natural family *Rubiaceæ*, growing in swamps.

Button-Tree. *Conocarpus erecta.* W. Indian tree of the natural family *Combretaceæ*, bearing its small flowers in round heads.

Button-Weed. Plants of the genus *Spermacoce*, natives of warm regions, natural family *Rubiaceæ.*

Buttonwood. *Platanus occidentalis.* Very large tree of the natural family *Platanaceæ*, native of N. America; known also as Plane-tree and American Sycamore.

Buttress. A pier of masonry built against a wall to withstand a pressure from within. It is most commonly used to resist the thrust of an arch or vault, but may also be employed under the principal beam of a roof. In Gothic architecture buttresses were of considerable projection in proportion to their breadth, they were diminished from the bottom by massive offsets, which were richly molded, and they were crowned with pinnacles.

Butyl. $CH_3.CH_2.CH_2.CH_2$–. Group C_4H_9–, combined with hydroxyl in butyl alcohol, with bromine in butyl bromide, etc.

Butyl Alcohol. $CH_3.CH_2.CH_2.CH_2OH$. Bpt. 106° C. Hydrate derived from the hydrocarbon butane; liquid of peculiar odor, present to some extent in fusel oil; called normal butyl alcohol. Three other forms are known: iso, pseudo and tertiary.

Butylene, or BUTENE. $CH_3.CH_2.CH:CH_2$. Bpt. −5° C. Gaseous hydrocarbon which combines readily with bromine. Isomeric forms are known, called pseudobutylene and isobutylene.

Butyric Acid. $CH_3.CH_2.CH.COOH$. Bpt. 163° C. Mon-

obasic acid, prepared by the saponification of its glyceride and by the butyric fermentation of glucose; occurring in butter. Liquid of offensive odor. Used in making its ethers.

Butyric Ether. $CH_3.CH_2.CH_2.COOC_2H_5$. Bpt. 120° C. Ethyl butyrate, prepared by the action of alcohol and sulphuric acid upon butyric acid; main constituent of the artificial essence of pineapple. Liquid of agreeable odor.

Butyrines. Compounds formed by the mutual action of glycerine and butyric acids. See GLYCERIDES. Tributyrine is one of the components of butter.

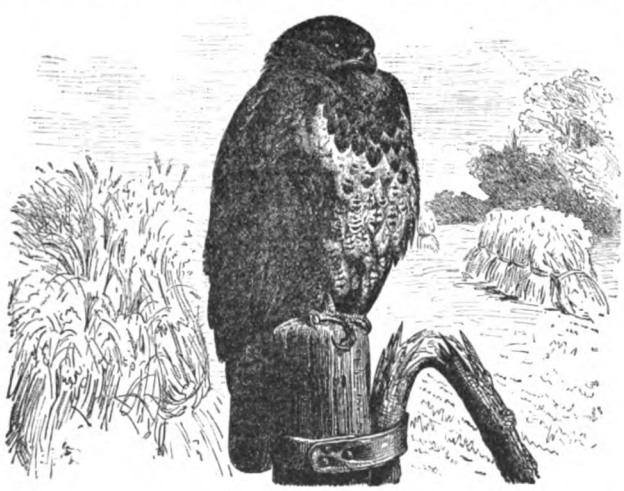
Buxtorf, JOHANN, 1564–1629. German Hebraist, prof. at Basel 1591. His Hebrew Lexicon, 1607, and other works, were enlarged by his son JOHANN, 1599–1664.

Buys-Ballot, CHRISTOPH HEINRICH DIEDRICH, 1817–1890. Prof. Utrecht 1847–87; director Meteorological Institute of the Netherlands; inventor of the Aeroklinoscope, the first apparatus used to announce by signals the expected wind.

Buys-Ballot's Law. Theorem announced 1860, according to which "if on any morning there be a difference between the barometrical readings at any two stations in Holland, a wind will blow on that day in the neighborhood of the line joining those stations, which will be inclined to that line at an angle of 90° or thereabouts, and will have the station where the reading is lowest on its left-hand side." This name is frequently but mistakenly applied to the law that "if you stand with your back to the wind, the lowest pressure will always be on your left hand in the northern hemisphere," Buchan's Law.

Buzz. An almost universal toy, made in a great variety of forms, one of the simplest being a dish of wood or metal pierced with two holes, through which a cord is passed, by means of which the buzz is whirled first in one direction, and then, when the cord is twisted, by unwinding, in the other. It is common as a toy among the American Indians, and the Eskimos. The latter make a buzz of ivory with a cord of sinew identical in form with that of Japan.

Buzzards. Hawk-like birds, of the Falcon family, and genus *Buteo*, characterized by having wings more than four times as long as the tarsus, the tail more than two-thirds the length of the wing, the tip of upper mandible not strongly hooked, the tarsus naked in front, covered by transverse scutellæ. These birds generally feed on mice, but also attack poultry and are known as Henhawks. *B. borealis* is the Red-tail, and *B. lineatus* the Red-shouldered Hawk. They breed in



Mouse-buzzard (*Buteo vulgaris*).

heavy timber, sometimes raising two broods in one season. There are several allied species in N. America, the sub-tropical forms having handsome plumage. They are slower and more awkward than Eagles and other Falcons. The lines distinguishing Buzzards are so loosely drawn that some members of allied genera are so-called; *e.g.*, *Archibutes lagopus*, the Rough-legged Buzzard. Most of the Buteones are known as Hawks. See ACCIPITRIDÆ.

Buzzard's Bay. An indentation in s. coast of Mass., inclosed in part by the Elizabeth Islands.

Buzz-Planer. Machine for planing or smoothing wood, in which a revolving cylinder carrying planer knives is so placed as to come just tangent to the plane behind it. The part of the table in front of the cylinder is lower by an amount equal to the thickness of chip which it is desired to remove, the difference in height of the two halves being adjustable. The piece of wood to be planed is held in the hands upon the table, and fed over the slit between the front and back of the table where the knives revolve.

By-Bidding. Bidding at an auction with no intention to buy, but solely to run up the price. The British Common-law Courts hold that such bidding is fraudulent, and gives to the purchaser the right to avoid the sale; the British Chancery Courts allowed the practice to some extent. In the U. S. the former view prevails in most jurisdictions.

Byerly, WILLIAM ELWOOD, Ph.D., b. 1849. Prof. Math. Harvard 1876. *Differential Calculus*, 1879; *Integral Calculus*, 1881–89; *Fourier's Series and Zonal Harmonics*, 1894.

By-Laws. Rules of a corporation, authorized by its charter, or those of an association, authorized by its members, for the government of its affairs.

Byles, JOHN BARNARD, 1801–1884. Queen's Sergeant, 1857; Justice of Common Pleas, 1858. *Bills of Exchange*, 1830.

Byles, MATHER, D.D., 1706–1788. Pastor in Boston 1733–77; noted as a wit, versifier and Tory.

Byng, GEORGE, R. N., 1663–1733. Admiral 1708, active against French and Spaniards; M.P. 1706–21; Viscount Torrington 1721.—His son JOHN, 1704–1757, Admiral 1748, was shot for a failure at Minorca.

Bynkershoeck, CORNELIUS VAN, 1673–1743. Pres. Supreme Court of Holland 1724. *Observationes Juris Romain*, 1710; Complete Works, 1766.

Bynner, EDWIN LASSETER, 1842–1893. American novelist, writing chiefly on colonial topics. *Agnes Surriage*, 1886; *Zachary Phips*, 1890.

By-Pass. (1) Channel by which fluids can be allowed to pass from one side of a valve or a pump where there is considerable pressure to the other side where the pressure is less, when a by-pass valve is opened. (2) Channel by which two systems or circuits may be connected together. (3) Means by which an intermediate system may be cut out, by coupling the extremes directly.

Byrd, or BIRD, WILLIAM, ab. 1538–1623. English musician, organist of Lincoln 1569.

Byrd, WILLIAM, F.R.S., 1674–1744. Va. planter, who determined the N. C. boundary 1728, and laid out Richmond and Petersburg 1733 on his own lands. *Westover MSS.*, 1841.

Byrom, JOHN, 1691–1763. English poet, disciple of Jacob Behmen. He wrote pastorals, hymns, satires, epigrams, epistles, and essays in verse, but pub. almost nothing. Wesley called him "an uncommon genius." *Poems*, 2 vols., 1773, repr. 1814; *Literary Remains*, 1857.

Byron, GEORGE GORDON NOEL, LORD, 1788–1824. English poet of commanding fame and influence in his day and for some time after. Unhappy results of heredity and early training placed him in revolt, and he loved to outrage and satirize society. His *Hours of Idleness*, 1807, was severely criticised, and avenged in *English Bards and Scotch Reviewers*, 1809. His more serious work began with *Childe Harold*, Cantos I. and II., 1812. Thenceforth during his brief and unhappy life he poured out a flood of splendid verse, ending with *Don Juan*. His heroes always breathe his own spirit of cynicism and defiance; epic, drama, or lyric are alike tragic, morose, or contemptuous. He remains a picturesque but somber figure, an artist in language, whose ideas are little valued. His death, while aiding the Greeks in their war for freedom, went far to atone for the errors of his life.

Byron, HENRY JAMES, 1834–1884. English dramatist. He burlesqued *Fra Diavolo*, 1858, and other favorites. *Our Boys*, 1878.

Byssogenous Glands, or BYSSUS GLANDS. Those that secrete byssus.

Byssus. Tuft of silken hairs by which certain bivalves anchor themselves in the sand or to objects. It is formed from the secretion of the byssus gland situated in the "foot" of the Lamellibranch.—Mycelium of Fungi.

Byzantine Architecture. Style of building that arose after the transfer of the Roman Empire to the East and the founding of Constantinople. It has been proposed to call it the Eastern Romanesque, and such a designation would be applicable. Its chief monument is the church, now the Mosque of Saint Sophia, but the same principles of construction and decoration employed in that building are to be found in many minor works. The methods of construction were Roman, and included the arch, the vault, the half-dome, and

the dome, but the Byzantine buildings present an entirely different aspect from the Roman, mainly because the builders discarded the Grecian architectural forms, which in Rome had been employed as decorations, and developed the ornamentation of their buildings out of the actual construction, and declassicized all their details. The principal remains of Byzantine architecture are domed churches, either circular or rectangular in plan, churches roofed with slabs of stone connecting the arches, and wooden-roofed churches following the plan of the basilica, with nave, aisles and apse. Byzantine building spread rapidly through Greece and Asia Minor, and exerted a powerful

Mosque of St. Sophia, Constantinople.

influence upon the building of the western shore of the Adriatic, notably in the case of St. Mark's in Venice and San St. Vitale in Ravenna. It also supplied the starting-point for the Saracenic architects, and the Mahometan architecture of Egypt

Mosque of St. Sophia

and Asia is ultimately derived from it. In a very degenerated form it has become the style of the Russo-Greek church.

Byzantine Art. Of the East-Roman period, dating from the 5th century. It still survives in Russia and the Levant, and was not displaced in Italy till the 14th century. The figure design is elongated and lifeless; a traditional religious style in which nature is ignored, controlled largely by the methods natural to MOSAICS (q.v.), in which its best works were done.

Byzantine Empire. See EASTERN EMPIRE.

Byzantine Historians. Those who treated of the events of the Eastern or Greek Empire, whose capital was Constantinople. PROCOPIUS (q.v.), d. ab.565, was the greatest. Then follows a long list, the chief being Agathias, 536–580; Menander Protector, ab.581; Theophilactus, d. ab.628; Joannes of Epiphaneia, from the same reign; the Emperor Constantine Porphyrogenitus, who reigned 911–959, and his contemporary Genesius; Joannes Cameniata; Leo Diaconus in 10th century; Nicephorus Bryennius, son-in-law of the Emperor Alexius Comnenus; Anna Comnena; Joannes Cinnamus in 12th century; Nicetas Acominatus, 13th century; Georgius Acropolita, 1220–1282; Georgius Pachymeres; Nicephoras Gregoras; the Emperor John Cantacuzenus; Joannes Cananus; Joannes Anagnostes; Michael Ducas, who wrote of the fall of Constantinople. Other historians and chroniclers swell the list. The best edition of these works is that pub. at Bonn in 48 vols., begun by Niebuhr, 1828–1855.

Byzantium. Town on Thracian Bosphorus, founded by Megarians 667 B.C.; taken successively by Medes, Athenians, and Spartans; destroyed 196; refounded by Constantine 324; dedicated May, 330, and renamed Constantinople.

Bzowski, or BZOVIUS, ABRAHAM, 1567–1637. Polish Ch. historian, who added 9 vols., 1616, to Baronius' *Annals*.

C

Caaba. See KAABA.

Caaing Whale. Species of porpoise, often stranded on British and other coasts. They are gregarious and have a leader whom they follow often to destruction. They feed on

Caaing Whale.

cephalopods and are from 16 to 24 ft. long. Also known as Pilot Whale, Social Whale, Grindhval, etc.

Cabal. Clique aiming to gain political and party ends through indirection and intrigue; especially the ministry of Charles II., 1667–73, whose initials spelled the word; viz., Clifford, Ashley (Shaftesbury), Buckingham, Arlington and Lauderdale.

Caballero, FERNAN. Pen name of DOÑA CECILIA ARRON, or DE BAER, 1796–1877. Spanish novelist; daughter of Böhl von Faber, long German consul at Cadiz; thrice married. *La Gaviota*, 1849, and others of her tales, were read throughout Europe and America.

Cabanel, ALEXANDRE, 1823–1889. French history, genre and portrait painter. Prof. Ecole des Beaux Arts.

Cabanis, PIERRE JEAN GEORGE, 1757–1808. Physician, prominent among the literary and philosophic men who stimulated the French Revolution; prof. Paris 1797. *Rapports du Physique et du Moral de l'Homme*, 1802.

Cabbage. *Brassica oleracea.* Biennial herb of the Mustard family, native of the seashores of Europe; cultivated and brought into many forms as a garden vegetable. It is grown in field culture only in the vicinity of large towns, or occasionally by farmers as a cattle food. The seeds are sown in a seed-bed early in May, and transplanted to the field in June or July, preferably in moist, mellow, rich soil. Subsequent cultivation is given by horse and hoe to keep the land clear of weeds till the plants cover the ground. The cabbage-worm (*Pieris rapæ*), a great enemy to its culture, may be kept in check by the application of pyrethrum powder, either dry or in solution. It has marked antiscorbutic properties, and is largely used as a food, but of no great value, as it contains about 94 per cent of water. It is very indigestible when cooked, but less so when raw. The Kerguelen's Land Cabbage, *Pringlea antiscorbutica*, is a plant of the same family.

Cabbage Insects. (1) Harlequin or Cabbage-bug (*Murgantia histrionica*); feeds also on turnips, etc.; half inch long, bluish-black with orange colored spots and stripes. Eggs laid under-side of leaf, several broods in a summer. Feeds by sucking sap, and not affected by poisons. (2) Cabbage-butterfly (*Pieris rapæ*, imported; *P. protodice*, native); measures two inches across expanded white wings. Male of *rapæ* has one, female two spots on upper side of fore wings; in *protodice* male has three, and female several, irregular spots. Tips of fore wings are black. Eggs laid under-side leaf; larva is green, with yellow stripes on back and spots on sides. These caterpillars are destroyed by the larvæ of the Ichneumon-fly, which deposits its eggs in the caterpillars. Use pyrethrum, air slaked lime, arsenites, etc. (3) Cabbage-maggot (*Anthomyia brassicæ*); very small larva of a small fly; infests crown or roots. Use sulphur and fertilize with kainite. (4) Cabbage-moth (*Plusia brassicæ*); infests also turnips, tomatoes, clover, lettuce, etc. Larva differs from that of (2) in being largest posteriorly and looping. Adult is dark gray, nocturnal, with silvery spot near middle of fore-wings. Eggs laid in clusters on leaves. Use kerosene emulsion.

Cabbage Palm. *Areca oleracea.* Common palm of the W. Indies; the young leaves of this and other species are used as a vegetable. In New South Wales, *Ptychosperma elegans.*

Cabbala. Jewish system of religious philosophy by which the rabbins professed to be able to explain all the difficulties of Scripture; akin to Neoplatonism.

Cabeira. In Pontus, Asia Minor; scene of defeat of Mithridates by Lucullus 71 B.C.

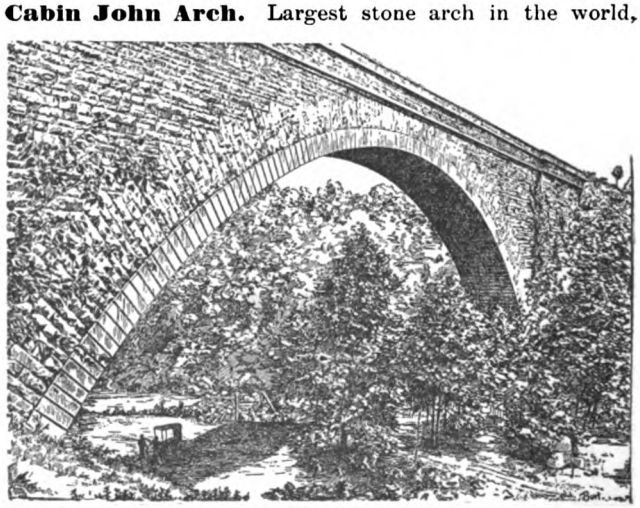
Cabeiri. See CABIRI.

Cabestaing, GUILLEM DE. Provencal poet, ab. 1175.

Cabet, ETIENNE. 1788–1856. French socialist, founder of a colony in Texas 1846, transferred to Nauvoo, Ill., 1849. *Hist. French Revolution*, 4 v., 1840; *Journey in Icaria*, 1841.

Cabinet. Ministers of a sovereign or of a State; unknown to British law, but necessary in any government not autocratic; formed in England 1693. In a republic they are advisers of the President, and each at the head of a department. In the U. S. there were in 1789 Secretaries of State, the Treasury, and War, an Attorney-Gen., and a Postmaster-Gen.; a Sec. of the Navy was added 1798, of the Interior 1849, and of Agriculture 1889.

Cabin John Arch. Largest stone arch in the world,



Cabin John Arch.

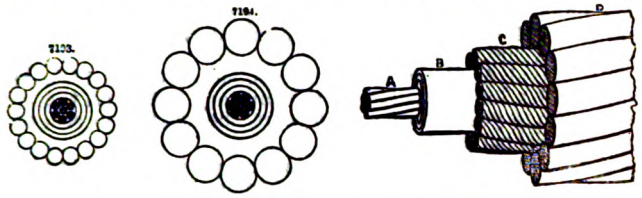
erected 1861 by Gen. M. C. Meigs to carry the Washington aque-

duct over the Cabin John Creek in Md. It is 220 ft. in span, 57 ft. rise, and 20 ft. high; the arch stones are 4 ft. thick at the center and 6 at the abutments.

Cabiri, or CABEIRI. Deities of Eastern origin, worshiped in parts of Greece and Asia Minor.

Cable. Large rope made of wires placed either parallel or twisted. That of the Brooklyn Bridge is nearly 16 inches in diameter and contains 19 strands, each having 290 parallel wires. Cables of other suspension bridges have twisted strands.

Cable, ELECTRIC. Set of parallel conductors, usually copper wires incased in some good insulating material and covered



Malta and Alex. Tel. cable, laid in 1861.

A, conducting copper strand; B, insulating gutta-percha; C, tarred yarn; D, iron wires.

on the outside for protection by iron or lead. It may be laid under water or buried in the ground; thus islands, or distant places separated by water, may be brought into telegraphic communication.

Cable, GEORGE WASHINGTON, b. 1844. American novelist, noted for his reproduction of Creole life and character. *Old Creole Days*, 1879; *The Grandissimes*, 1880; *Dr. Sevier*, 1883; *The Silent South*, 1885; *Bonaventure*, 1888; *John March, Southerner*, 1895.

Cable Railway. Railway in which the cars are propelled by a moving cable griped by two wheels, so that the velocity of a car may be lessened by relaxing the adhesion. The first one successfully operated on this plan was in San Francisco 1873; the system has since been applied to many lines in several large cities, one of the latest being on Broadway in New York. For steep grades, where horse cars were drawn with difficulty, the cable lines succeeded, but are now gradually giving way to systems of electric traction. A speed of 10 m. or more per hour is usual on suburban cable roads. The principal defect of the system is in the breakages of the cable, which cause the stoppage of all traffic on the line.

Cable Towing. System of towing boats by the help of a cable lying in the bed of the river or canal, and wound on a drum which is turned in the boat; mainly used in France and Germany.

Cabling. Decorating a column with convex moldings in the direction of its length. The column thus decorated is said to be cabled, while if the moldings be concave it is said to be fluted.

Cabochians. Butchers in Paris; headed by Jean Caboche; devoted to the Burgundians; masters of Paris 1412–13 and 1418. The civil war ended with the assassination of John, duke of Burgundy, 1419.

Cabot, JOHN, d. ab. 1498. Venetian navigator who, under commission of Henry VII., embarked from Bristol 1497, discovered the N. American continent at Nova Scotia or Newfoundland, and sailed s. as far as Florida.—His son, SEBASTIAN, ab. 1477–1557, reached Hudson's Bay 1517, and what is now Argentina 1526.

Cabral, or CABRERA, PEDRO ALVAREZ, ab. 1460–ab. 1526. Portuguese navigator who on the way to India discovered Brazil 1500.

Cabrera, RAMON, 1810–1877. Carlist leader in Spain.

Cabrera Bobadilla y Mendoza, LUIS GERONIMO FERNANDEZ DE, Count of Chinchon, ab. 1575–1647. Viceroy of Peru 1629–39.

Cabs. Two- or four-wheeled vehicles for public hire, officially designated as hackney-carriages in England, under which name they have been in use since 1605. In 1662 in London 400 were taxed and licensed. Until 1790 they consisted chiefly of dilapidated private carriages, and a few years later the adoption of the French form of "cabriolets de place" gave rise to the present name. The hansom, patented 1834, has been improved till it stands first in public favor. This form of cab was used in Paris as early as 1672. In all countries cabs are licensed and fares fixed by municipal regulations.

Cabul. Capital of Afghanistan, on right bank of Cabul R., at junction of the Loghar, in a valley nearly surrounded by

The Bala Hissar and City of Cabul from the upper part of the Citadel.

mountains. Taken by Tamerlane ab. 1400; by the British 1839 and 1879. Pop. ab. 60,000.

Cacao. See CHOCOLATE BEAN.

Cacao Butter. Mpt. 30°–33° C. Yellowish-white fat, hard at ordinary temperatures; prepared from the fruit of *Theobroma Cacao*. Composed largely of glycerin, stearin and olein. Used in the preparation of suppositories and cosmetics. Adulterations are numerous. Also called Oil of Theobroma.

Caccini, GIULIO, called ROMANO, ab. 1558–1640. Singer and musical composer, one of the inventors of the opera. *Dafne*, 1594; *Euridice*, 1600; *Le nuove musiche*.

Caceres, ANDRES AVELINO, b. 1838. Pres. of Peru 1886 and 1894; Minister to Spain and France 1891.

Cachalot, or SPERM WHALE. See CATODONTIDÆ.

Cachet, LETTRES DE. French orders of arrest and imprisonment without trial; abolished Jan. 15, 1790.

Cachexia. Disturbances of the nutrition, characterized by pallor, loss of flesh, and weakness; due to constitutional diseases, such as cancer, tuberculosis, or malaria, or to chronic poisoning by metals.

Cacholong. SiO_2. Silica, usually containing water; opaque, variously colored, impure opal. The word is of Asiatic origin.

Cachucha. Andalusian dance, originally sung to the guitar, in 3-4 time, much resembling the Bolero.

Cacodyl. $As_2(CH_3)_4$. Arsentetramethyl; combination of the methyl group with arsenic; liquid, boiling at 170° C., with disagreeable odor; inflammable if brought in contact with air. Made by distilling arsenic trioxide and potassium acetate, treating the product with hydrochloric acid, and then with zinc.

Cacodyl Compounds. Combinations containing arsenic and methyl groups. All possess an unbearable odor.

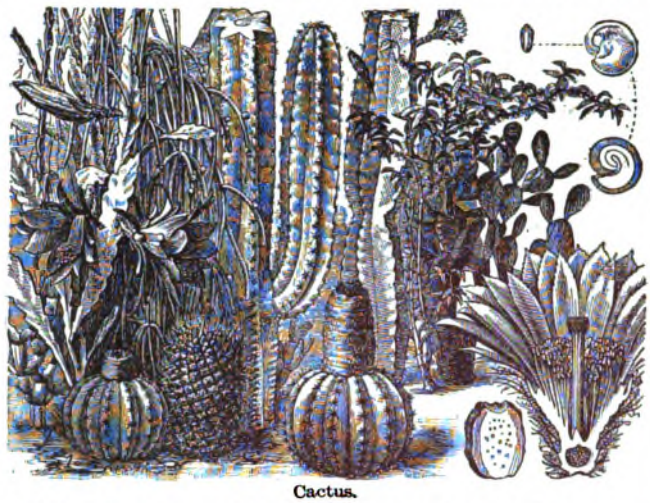
Cacolet. Contrivance arranged on each side of the pack-saddle of a mule for transportation of the wounded in Indian warfare; a kind of travois with seat and back support, issued to troops at the rate of 4 per 1,000 men.

Cacoxenite. $Fe_4P_2O_{11}+12aq$. Hydrous ferric phosphate, yellowish in color, sometimes found with bog-iron ore.

Cactaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones;* comprising 15 genera and ab. 1,050 species, growing in abundance in the tropics and warm countries, mostly American. Called the Cactus family.

Cactus. Many species of fleshy and spiny plants of the natural order *Cactaceæ*; widely cultivated. Natives of hot and

dry climates, either climbing or erect; some attaining a height



Cactus.

of 50 ft. The fruit contains numerous seeds and often eaten. Many varieties are found in Mexico.

Cacus. Fire-vomiting and cattle-stealing giant, son of Vulcan, who lived in a cave under Mount Aventine: slain by Hercules.

Cadahalso, Jose de, 1741–1782. Spanish poet and dramatist.

Cada Mosto, Luigi da, 1432–1480. Venetian navigator, who explored the w. coast of Africa to 13° n. lat. 1455–56.

Cadastral Surveying. Surveying which furnishes data and maps for the use of assessors of property; carried on in Europe on an extensive scale and with a high degree of precision.

Cadaverine. Poisonous ptomaine, found in putrefying animal tissues; formed by the action of certain bacilli and supposed to be the cause of the symptoms occurring in Asiatic cholera.

Caddis (or Caddice) **Fly.** Neuropterous insect of the family *Phryoganeidæ*, and it is known by its larvæ (Cad-bait), of which anglers make great use. Called case-worms, from their living in a case covered with little bits of wood or sand, which they draw after them as they go. The eggs of the female are inclosed in gelatinous capsules which swell in the water and attach themselves to stones.

Caddoan Indians. N. American family of aborigines comprising (1892), Arikara, 416; Pawnee, 798; Wichita, 151; Towakarchu, 133; Waco, 41; Kichai, 51; Caddo, 530. Of these the Arikara are now settled on the Fort Berthold Reservation, N. D., and the remainder in the I. T. The Arikara group formerly lived on the Missouri, but were driven by the Dakotas to their present location. The Pawnees were settled on the Platte R., Neb., and were removed to I. T. in 1876. The Wichita, Towakarchu, Waco, Kichai and Caddo tribes inhabited e. and n. e. Texas, Ark., and La., between the Red, Sabine, and Brazos Rivers.

Cade, Jack. Leader of an insurrection in s.e. England 1450. With ab. 15,000 men he defeated the king's forces at Sevenoaks, June 18th, entered London, and beheaded Lord Say, the treasurer. He was slain July 12.

Cadell, Francis, 1822–1879. Scottish explorer in Australia 1850–59.

Cadence. In music, sequences of harmonies which bring compositions, or parts of them, to a close. It is perfect when the effect is completely restful to the ear, as the progression from dominant to tonic harmony, interrupted when a progression which promises rest is departed from before completion, and imperfect when there is no interruption and the effect is yet unsatisfactory, as from tonic to dominant harmony.

Cadence. Measure regulating the length and time of the pace of the soldier in marching. The pace in quick time is 30 inches at the rate of 120 per minute; in double time, 36 inches and 180 per minute; in route step it is omitted, but the general alignment is preserved.

Cadency. Heraldic method of distinguishing individuals or branches of the same family all of whom bear the same arms. The marks of cadency charged on the shield are, for the eldest son, a label; for the second, a crescent; third, mullet; fourth, martlet; fifth, annulet; sixth, fleur-de-lys; seventh, rose; eighth, cross-moline; ninth, double quaterfoil.

Cadenza. Flourish introduced shortly before the close of a musical composition. In instrumental music it was formerly left to the fancy of the player (its place being indicated by a fermata, 𝄐), and is generally a sort of free improvization on the principal themes of the movement. Modern composers generally write out their cadenzas. Vocal cadenzas are merely passages designed to display flexibility of voice and skill in execution.

Cadessia. See Kadessia.

Cadet. Orig., younger son; in the U. S., youth receiving instruction at U. S. Military or Naval Academy. Each Congressional district and Territory is entitled to one at West Point; ten are appointed at large. They must be between 17 and 22 years old and 5 ft. high, and pass a prescribed examination. They receive $540 per year. Since its foundation 1802 to 1894, 7,581 have been admitted and 3,616 graduated. Sixty-seven per cent of those appointed have been admitted. The course requires 4 years.

U. S. Naval Academy at Annapolis, Md., founded 1845, has similar rules for admission as the military academy, the age being 15 to 20 years, the course 6 years, the last two at sea, and the pay $500 per year.

Cadiz. Fortified city of s. Spain, on a peninsula jutting into the Atlantic. It is an important commercial port, though less so than in the 17th and 18th centuries. Occupying an almost insular situation, it is much resorted to in the heat of summer.

Port of Cadiz.

It was founded by Phœnicians ab. 1100 B.C., taken by the Romans 206 B.C., and from the Moors by the Spaniards 1262; burned by the English 1596; blockaded by the French 1810–12, and held by them 1823–28; cradle of the Spanish revolution of 1868. Pop., 1887, 62,531.

Cadmia. Several zinc compounds, natural or artificial.

Cadmium. Cd. At. wt. 112, sp. gr. 8.6, sp. ht. .054. White metal, discovered by Stromeyer 1817. Occurs principally in zinc-blende, from which it is prepared by distillation and treatment of the distillate with charcoal. It is acted upon very slightly by air. If heated it burns with a brown smoke, forming the oxide. It dissolves with difficulty in hydrochloric and sulphuric acids, and readily in nitric acid. Its molecular and atomic weights are the same.

Cadmium Carbonate. $CdCO_3$. White insoluble powder. Made by precipitating a soluble cadmium salt with a soluble carbonate.

Cadmium Chloride. $CdCl_2.2H_2O$. Mpt. 514° C. Made by treating the oxide or hydroxide with hydrochloric acid. Sublimes in scales.

Cadmium Cyanide. $Cd(CN)_2$. White precipitate, formed by adding potassium cyanide to concentrated solutious of cadmium salts. It is soluble in excess of precipitant.

Cadmium Hydroxide. $Cd(OH)_2$. White powder, precipitated from soluble cadmium salts by soluble hydroxides.

Cadmium, Metallurgy of. Found in nature as a constituent of many zinc ores, but only in small proportion. Silesian calamine (zinc silicate) carries up to 5 per cent; Hungarian blende (zinc sulphide) averages almost 2 per cent; and similar quantities are found in zinc ores in many parts of the world. In the U. S. noticeable amounts are found on the zinc ore from Friedensville, Pa., and on blende from Missouri. The cadmium occurs as a thin, yellow incrustation, chemically consisting of cadmium sulphide, known mineralogically as Greenockite.

When zinc ore is being reduced in retorts, a yellowish-brown

smoke coming off before the bluish-green flame of zinc appears indicates the presence of cadmium, the smoke being a mixture of the oxides and carbonates of zinc and cadmium, and its early formation being due to the fact that cadmium is more easily reduced and is more volatile than zinc. Zinc fumes from lead-smelting furnaces, as well as the accretions sometimes forming directly in the upper part of blast-furnaces (*cadmia*), frequently contain cadmium.

Only in Silesia is metallic cadmium prepared. The process there used is based on the superior volatility of cadmium to zinc. Large receivers are adapted to the mouths of the zinc retorts, in which the brown fume coming off during the first part of the distillation is condensed. This fume will contain about 30 per cent of cadmium, and is put into a zinc muffle kept at a moderate red heat in another furnace. In the conical iron condenser attached to this the brown powder condenses in a much purer state. This concentrated brown powder is then mixed with charcoal and heated moderately in small cylindrical cast-iron retorts, fitted with condensers. The heat not being sufficient to reduce and volatilize zinc, the cadmium is distilled off and condensed in the pure metallic state. It is cast into small, cylindrical bars about the size of a lead-pencil. Selling price varies between $1 and $1.50 per pound. The amount produced yearly is not over two tons.

Commercial cadmium usually contains five to ten per cent of zinc, and sometimes a little tin and iron. Pure cadmium is a white metal, with a sp. gr. of 8.7, in hardness and strength between tin and gold. Melts at 320° C., volatilizes at 770° C. Its specific heat is 0.0567, conductivity for heat 577 (silver = 1,000), conductivity for electricity 221 (silver = 1,000). Both malleable and ductile.

Cadmium was discovered in 1817 by Stromeyer and Hermann. Many years later a use was found for it, when Wood discovered its remarkable effect in reducing the melting-points of other metals. If ten per cent is added to Rose's fusible alloy (2 bismuth, 1 tin, 1 lead), the melting-point is reduced from 94° C. to 75° C. Wood's alloy is composed of 2 cadmium, 2 antimony, 4 lead, and 8 bismuth, and melts at 65° to 70° C. Lipowitz's fusible alloy contains 8 lead, 15 bismuth, 4 tin, and 3 cadmium; it softens at 55° C. and melts at 60° C. These fusible alloys are used for safety-plugs, which melt if overheated, and are particularly suited for the automatic fire-extinguishers or sprinklers. Cadmium is also used in reducing the melting-points of solders, common tin-man's solder melting at 136° when it contains 8 per cent. Cadmium amalgam is used by dentists for filling teeth.

Cadmium Nitrate. $Cd(NO_3)_2+4H_2O$. Straw-colored columns or needles. Mpt. 100° C. Made by dissolving the metal or oxide in nitric acid and evaporating the solution.

Cadmium Oxide. CdO. Brownish-black powder, made by heating the nitrate.

Cadmium Sulphate. $3CdSO_4.8H_2O$. Made by treating the oxide with sulphuric acid. The salt crystallizes from water; crystals are efflorescent.

Cadmium Sulphide. CdS. Yellow powder, precipitated from soluble cadmium salts by hydrogen sulphide; insoluble in dilute acids; used as a pigment. See GREENOCKITE.

Cadmus. Son of Agenor, king of Phœnicia; founder of Cadmea, afterward the citadel of Thebes; sower of the dragons' teeth from which sprung the ancestors of the Thebans; said to have introduced into Greece, from Egypt or Phœnicia, an alphabet of 16 letters.

Cadoudal, GEORGES. 1771–1804. Leader of the Chouan revolt in Brittany 1794–1800; guillotined in Paris for plots against Napoleon.

Cadran, LE. THE DIAL. Game of solitaire played with two packs of cards. Forty cards are dealt out face up in four rows one beneath the other. The eight aces form the foundation cards, and are built upon in sequences up to kings.

Caduceus. Herald's staff borne by Mercury; often represented in art.

Caducibranchiata. See DEROTREMA and SALAMANDRINA.

Caducichordata. See ASCIDIACEA.

Caducous. Calyx or corolla of flowers when these parts fall away at the beginning of anthesis, as the calyx of the Bloodroot and Poppy.

Cadwalader, JOHN, 1742–1786. American general, active in the battles of 1776–77.

Cæcilius Statius, d. 168 B.C. Roman comic poet, once a slave; author of 40 plays, of which we have only fragments. The Romans ranked him with Plautus and Terence, and praised his skill in the arrangement of his plots.

Cæcina, AULUS, d. 79. Roman general, executed for treason.

Cæcum. Dilated extremity of the colon, on the right side of the body, into which the small intestine and the vermiform appendix open.

Cædmon, d. ab. 683. Anglo-Saxon sacred poet; monk of Whitby, near York. He paraphrased parts of Genesis and other Bible books.

Caen. City of n. France, on the Orne, near the Channel. It was held by the Normans from 912; taken by the English 1346 and 1417, and recovered by the French 1450; noted for stone-quarries. William the Conqueror and his queen are buried here. Pop., 1891, 45,201.

Cænozoic. All strata above the chalk.

Caere. Ancient Etruscan town near Rome, noted for its tombs and the antiquities found in them. The Etruscan Museum of the Vatican is rich in these objects. Especially important are those from the tomb called the Grotto Regolini Galassi, opened 1829.

Caerleon. Ancient town of Wales, on the Usk; traditionary residence of King Arthur. It has many Roman antiquities.

Cæsar. Orig., a family name, then a title borne by the Roman emperors and their heirs. "The Twelve Cæsars," whose lives Suetonius wrote, extend to Domitian; the Julian line ended with Nero.

Cæsar, CAIUS JULIUS, 100–44 B.C. Founder of the later Roman monarchy. At 22 he had gained distinction as an orator. He was pontifex maximus 63, prætor 62, consul 60, when he formed with Pompey and Crassus the first triumvirate. In 59 both Gaul and Illyricum were assigned him with four legions; nine years were spent in the conquest of Gaul and Britain. Ordered by the Senate, Jan. 1, 49, to disband his army, he crossed the Rubicon and marched toward Rome. The forces of the Senate under Pompey deserted to him; cities flung open their gates. He defeated Pompey's adherents in Spain, and Pompey himself at Pharsalia 48, the King of Pontus 47, Scipio and Cato in Africa 46, and Pompey's sons in Spain 45. In 46 he was made dictator for 10 years, celebrated four triumphs, and reformed the calendar. In 45 he was made imperator and dictator for life, and his person declared sacred. His plans for public works, improvement of the laws, and protection of the Empire, were cut short by his assassination in the Senate House. Of his writings only the Commentaries on the Gallic and Civil wars are extant.

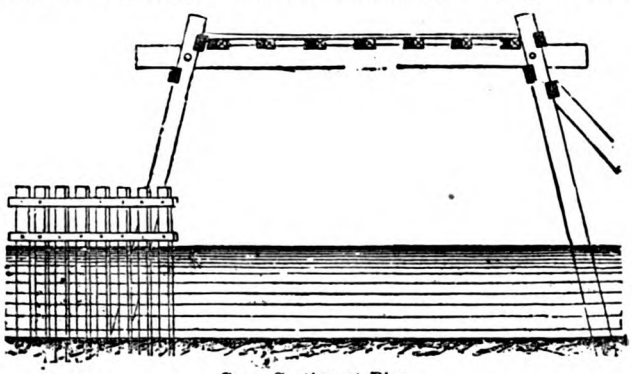
C. Julius Cæsar.

Cæsarea. City on coast of Syria, rebuilt by Herod and made Roman capital of Palestine. Gentiles were first received here by St. Peter into the Church: Acts x., xi. Here St. Paul was imprisoned, Origen dwelt, and Eusebius was bishop.

Cæsarea Philippi. City in northern Palestine, under the spurs of Mount Hermon; now Banias.

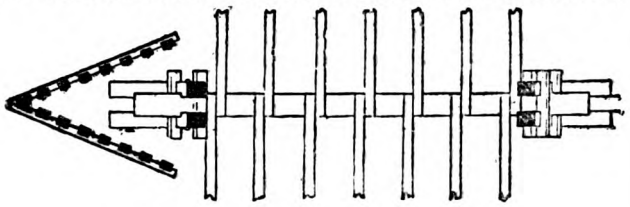
Cæsarian Section. Operation performed by cutting through the abdominal walls and into the uterus for the removal of a fœtus when the mother is dead or when other methods are impossible. Julius Cæsar is said to have been born in this manner. Formerly the procedure was resorted to only in desperate cases, but now a large proportion of those operated upon recover, provided the conditions are fairly favorable.

Cæsar's Bridge. Pile or trestle-bridge built by Cæsar 55



Cross Section at Pier.

B.C. over the Rhine, probably near Bonn. Cæsar's commentaries on the Gallic war describe the method of construction.



Plan at Pier.

Bridge thrown across the Rhine by Julius Cæsar.

Cæsium. Cs. At. wt. 132.9. Discovered by Bunsen and Kirchhoff in 1860 by spectrum analysis. It was isolated 1882. It is a soft, white metal, Mpt. 26.5° C., Sp. gr. 1.88, and ignites on water or in the air. When an electric current is allowed to act upon the fused cyanides of cæsium and barium, aluminium poles, cæsium is obtained. The compounds of cæsium are similar to those of potassium and rubidium. The spectrum of cæsium shows two distinct blue lines; hence its name. It occurs in POLLUCITE (q.v.), in Lepidolite and some salt springs.

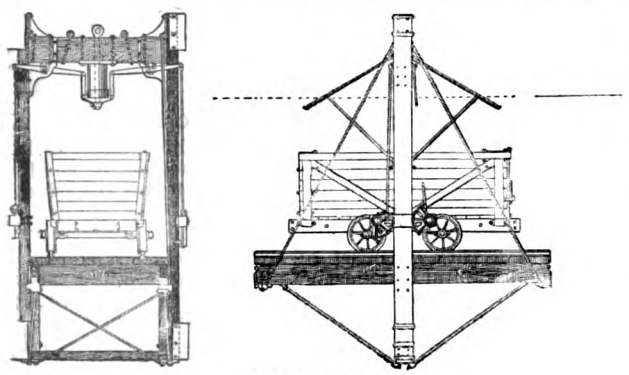
Cæstus. Ancient boxing-glove made of leather thongs, often weighted with lead.

Caffarelli, 1703–1783. Name adopted by Gaetano Majorano, out of gratitude to his first teacher, Caffaro; male soprano singer, called by Porpora "the greatest singer in Europe." He went to London 1737, and sang in Handel's operas. At 65 he had earned enough money to buy a dukedom in Italy.

Caffeine, or THEINE. $C_8H_{10}N_4O_2+H_2O$. Trimethylxanthine, crystallizing with water in long silvery needles; weak base. Is a urea derivative, and the active constituent of coffee, tea and guarana. Used as a heart stimulant and in relieving headache.

Caffres, or CAFRES. See KAFFIRS.

Cage. In mining, a framed structure having one or more floors on which men can stand, or loads be placed, that are to



Safety Cage.

be raised or lowered in the shaft. A safety-cage is provided with appliances for preventing accidents by breakage of cable.

Cagliari. City of Sardinia, on the s. coast. Pop. ab. 40,000.

Cagliari, PAOLO. See VERONESE.

Cagliostro, ALEXANDER, COUNT, 1743–1795. Italian impostor who traveled through Europe as an alchemist; imprisoned in the Bastile 1785–86, and near Urbino from 1789; real name, Giuseppe Balsamo.

Cagots. Race of social outcasts in s. w. France, resembling the gypsies; supposed to be descended from the Visigoths. Their legal disabilities were removed 1795.

Caiaphas. Jewish High Priest who condemned Jesus; deposed 36.

Cailliaud, FREDERIC, 1787–1869. French explorer of the White Nile 1821–22. *Journey to Merse*, 4 v., 1823–26.

Caillié, RENE, 1799–1838. French traveler. His journey from Sierra Leone to Timbuctoo, and thence to Tangier, 1827–28, gained a prize of 10,000 fr. *Journal*, 1830.

Caiman. See PROCŒLIA.

Caimito. *Lucuma Caimito.* Large tree of the natural family *Sapotaceæ*, bearing an edible pulpy fruit.

Cain. Eldest son of Adam and Eve; murderer of Abel.

Cain, AUGUSTE NICHOLAS, 1822–1894. French sculptor, follower of Barye. His *Tigress with Cubs* is in N. Y. Central Park.

Caine, THOMAS HENRY HALL, b. 1853. English novelist. *The Shadow of a Crime*, 1885; *The Deemster*, 1887; *The Scapegoat*, 1892; *The Manxman*, 1894.

Caines, GEORGE, 1771–1825. Legal writer. *Lex Mercatoria Americana*, 1802; *Practice of the N.Y. Sup. Court*, 1808.

Cainites. Gnostic sect ab. 130. It honored Cain and Judas.

Ca ira. Parisian street-song of the Reign of Terror; suppressed 1797.

Caird, EDWARD, LL.D., b. 1824. Prof. Glasgow Univ. 1866; expounder of Kant, 1877–89, and Hegel, 1883. *Evolution of Religion*, 1893.—His brother JOHN, D.D., LL.D., b. 1820, prof. Glasgow 1862, pub. *Religions of India*, 1881; *Spinoza*, 1886.

Caird, MRS. MONA (ALLISON). English novelist. *Whom Nature Leadeth; One that Wins; Daughter of Danaus*, 1894.

Cairn. Artificial heap or pile of rough stones; in prehistoric times used for sepulchral purposes, like BARROWS (q.v.), which differ in being made of earth. Sepulchral cairns are especially numerous in Ireland, the Scottish Isles, and Brittany. They are found of all sizes up to and over 300 ft. in diameter, or 70 ft. in height; some have interior tomb chambers built of large stones. The latter are the later and belong to the Bronze Age.

Cairnes, JOHN ELLIOTT. 1823–1875. Prof. Dublin 1856, Galway 1860, and London 1866; political economist. *Logical Method of Political Economy*, 1857; *The Slave Power*, 1862; *Some Leading Principles of Political Economy Newly Expounded*, 1874.

Cairngorm Stone, or SMOKY QUARTZ. SiO_2. Variety of quartz, of smoky appearance due to titanic oxide, bituminous matter, or other dark-colored impurity; used in jewelry; found in s.w. Aberdeenshire.

Cairns, HUGH MCCALMONT, EARL, 1819–1885. Irish M. P. 1852; Attorney-Gen. 1866, Lord Chancellor 1868 and 1874–80.

Cairns, JOHN, D.D., LL.D., 1818–1892. Prof. U. P. Theol. Hall, Edinburgh, 1867. *Life of John Brown, D.D.*, 1860; *Unbelief*, 1881.

Cairo. Capital and chief city of Egypt, on e. bank of the Nile, near the Delta; founded 641; enlarged by Saladin 1166; taken by the Turks 1517; held by the French 1798–1801. It con-

Cairo.

tains many fine mosques, and the Azhar University, founded 971, which attracts students from all Mohammedan countries. The Great Pyramids of Ghizeh are ab. 15 m. s.w. Pop. 374,900, of whom ab. 21,000 are Europeans.

Cairo. Capital of Alexander co., Ill., at junction of Ohio and Mississippi; important shipping point. Pop., 1890, 10,324.

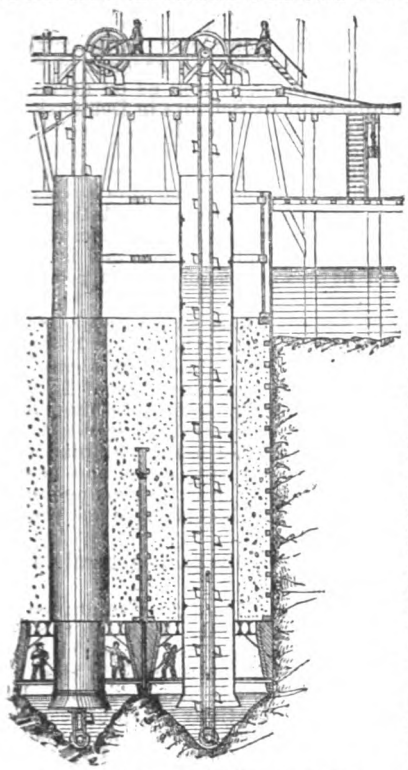
Cairoli, BENEDETTO, 1825–1889. Premier of Italy 1878–81.

Caisson, or COFFER. Sunken panel of a ceiling.

Caisson. Carriage assigned to each gun in a battery of field artillery. It carries three ammunition chests each containing 42 rounds, and each chest is interchangeable with that of the limber; it also carries a spare wheel in rear.

Caisson (BOX). Large water-tight box, open at the top, used for building a pier. The masonry is laid in the bottom of the caisson, which sinks as the weight increases, until it reaches the foundation. The sides of the caisson are then removed, the bottom remaining underneath the pier. Foundations ab. 30 ft. deep may be constructed by this method. A pneumatic caisson is a permanent structure of timber, upon which a pier is built and sunk to its foundation. The cais-

son is hollow, and into it compressed air is forced so as to expel the water and permit workmen to excavate the earth. Access to and from the caisson is effected through an air lock. Foundations ab. 100 ft. deep have been sunk by this method.



Caisson, Bridge of Kehl on the Rhine.

Caisson Disease. Disease peculiar to persons, such as divers, who are exposed to excessive pressure of air; characterized by severe pains in almost any portion of the body, loss of feeling or paralysis in the legs, and retention or incontinence of urine; believed to be due to interference with a proper circulation of the blood in the spinal cord. It attacks workmen who remain too long in the compressed air of a pneumatic caisson. The chief engineer of the Brooklyn bridge, W. A. Roebling, has been an invalid for many years, owing to his too zealous devotion to the work of founding the towers of that great structure in 1871.

Caius, JOHN, M.D., 1510–1573. Physician to Edward VI., Mary and Elizabeth; founder of Caius College, Cambridge, 1557, and its master 1559. *Sweating Sickness*, 1552.

Cajeput. Oil derived by distillation from the leaves of *Melaleuca minor*, tree of the Myrtle family, native of Australasia.

Cajetan, THOMAS (DE VIO), 1469–1534. General of the Dominican order 1508; cardinal 1517, and pope's legate in Germany; encountered Luther at Augsburg 1518; Bp. of Gaeta 1519. Commentary on Aquinas' *Summa*, 1507–22.

Caking Coal. Bituminous coal that becomes pasty and runs together into a coherent mass when heated to a high temperature under proper conditions. To what this change is due is not understood. Coke is made from this coal. The coal fields of s. w. Pa. are rich in it. Westmoreland, Pa., coal contains 60 fixed carbon, 33 volatile matter, and 7 ash. See COAL.

Calaba. *Calophyllum Calaba.* Tree of the Gamboge family, native of tropical America.

Calabar Bean. *Physostigma venenosum.* Vine of the Bean family, bearing poisonous and medicinal seeds; native of tropical Africa. It is used by the natives of Africa as an ordeal poison and employed in medicine as an antispasmodic. Is highly poisonous and contains two alkaloids, eserine or physostigmine and calabarine, the former of which is used to contract the pupil and in the treatment of a number of diseases of the eye.

Calabash. Large tree of the natural family *Bignoniaceæ*, *Crescentia Cujete*, native of tropical America. The shells of the fruit are applied to the manufacture of bowls, spoons, etc.

Calabria. (1) Ancient province of s. e. Italy. (2) S.w. Italy, anciently Bruttium.

Calais. Seaport of n. France, on Strait of Dover; taken after a year's siege by Edward III. 1347; held by England till 1558, and by Spain 1596–98. Pop., 1891, 56,867.

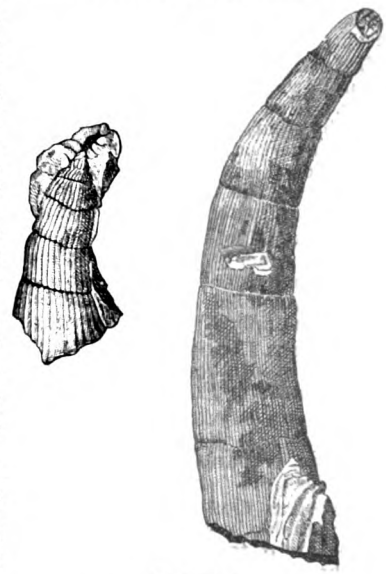
Calamander Wood. *Diospyros quæsita.* Large tree of the Ebony family, native of Ceylon. Its very hard wood is used in the manufacture of boxes, etc.

Calambac Wood. *Aloexylon Agallochum.* Tree of the Bean family, producing highly odoriferous wood, used in perfumery; native of Cochin China.

Calamine. Zn_2SiO_4+aq. Several minerals that contain zinc; especially the hydrous zinc silicate, one of the most valuable zinc ores. See SMITHSONITE.

Calamint. Fragrant, perennial herb of the Mint family, genus *Calamintha.* A decoction of the leaves is used as a medicine in chest troubles.

Calamites. Genus of Carboniferous plants closely allied to the modern scouring-rushes (*Equisetum*), but much larger. Their remains occur abundantly in the Coal Measures, usually in the form of fluted casts of the central cavities of the stem. They flourished in Carboniferous and Triassic eras, forming large trees, whose trunks and foliage contributed largely to the material from which coal has been formed.



Calamites.

Calamodendron. Genus of fossil plants allied to, or identical with, Calamites; closely related to the scouring-rushes of to-day, but with stems more highly developed.

Calamus. *Acorus Calamus.* Plant of the natural family *Araceæ*, growing in swamps in the n. hemisphere. Called Sweet-flag, and planted for its officinal roots.

Calamus. Tubular, horny quill of a feather; thence reed-pen of the ancients.

Calamus, SWEET. Grass of the genus *Andropogon*, native of India, yielding a perfumery oil.

Calamy, EDMUND, 1600–1666. One of the Westminster divines, and one of the authors of the document signed, from their joint initials, "Smectymnuus," 1641. He declined a bishopric, and was ejected 1662.—His grandson and namesake, 1671–1732, was another eminent London Nonconformist.

Caland, PIETER, b. 1826. Dutch engineer, noted for coast-works, as at Rotterdam.

Calas, JEAN, d. 1762. Protestant tradesman of Toulouse, unjustly executed for murder. Voltaire vindicated his memory, protected his family, and made his case famous.

Calathiform. Bowl-shaped corollas of certain plants.

Calatrava, ORDER OF. Founded 1158 by Sancho III. of Castile.

Calaverite. $AuTe_4$. Gold and silver telluride, named from Calaveras co., Cal.

Calcar. Spurs of rasorial birds; also rudiments of hind limbs of certain snakes.

Calcarate (SPURRED). Projections from the corolla or calyx of flowers.

Calcarea. See CALCISPONGLÆ.

Calcareous Spar. See CALCITE.

Calceolate. Having the form of a slipper or shoe, as the flowers of *Calceolaria* and *Cypripedium.*

Calchas. Greek soothsayer at Troy.

Calciferous Glands. On the spinal root-ganglia of frogs, which secrete a chalky substance.

Calciphora. See DECAPODA and DIBRANCHIATA.

Calcispongiæ, or CALCAREA. Calcareous sponges, *i.e.*, those whose skeleton consists of separate, needle-like, or often six to eight-rayed calcareous spicules. There are three families: *Asconidæ*, *Leuconidæ*, and *Syconidæ*. They are the simplest and most regular sponges. A fossil family has been discovered whose spicules are interwoven like the strands of a rope. This group is named *Pharetrones.*

Calcite. $CaCO_3$. Natural calcium carbonate containing 44 per cent carbonic dioxide; one of the most abundant minerals, occurring under diverse conditions and in a great variety of forms, many being known by independent names, as Iceland Spar, Dog-tooth Spar, Satin Spar, Argentine, Calcareous Spar, Calc-Spar, etc. When pure, it is colorless and frequently transparent. Its fundamental crystalline form, obtained by cleavage, is an obtuse rhombohedron. Transparent varieties exhibit the phenomena of double refraction. It is the essential mineral constituent of common limestone, and, with magnesium carbonate, makes the rock dolomite. It is common as a gangue in deposits of silver, copper, and lead ores.

Calcium. Ca. At.wt. 39.65, Sp. gr. 1.577, Sp. ht. 0.17. Prepared by Bunsen as an amalgam; afterward, 1856, in metallic condition by Matthiessen. It occurs in limestone, marble, chalk, coral, calc-spar, dolomite, gypsum, anhydrite, etc. It may be

obtained by electrolysis of the chloride, or by heating sodium with calcium iodide in a closed vessel. It is a yellow metal, tenacious and malleable. It is rapidly oxidized in moist air, and decomposes water with violence.

Calcium Carbonate. $CaCO_3$. Widely distributed in nature, occurring chiefly as limestone, marble, dolomite, and chalk. It occurs as ICELAND SPAR and ARAGONITE (q.v.). It is made by treating a soluble calcium salt with a solution of ammonium carbonate; is insoluble in water, soluble in the ordinary acids and in a water solution of carbon dioxide, and is used as a flux for the manufacture of glass, for the preparation of lime, and in metallurgical processes.

Calcium Chloride. $CaCl_2$. Found in nature in combination with other chlorides and in sea-water. It is made by dissolving lime or calcium carbonate in hydrochloric acid. It is extremely soluble in water, and is very deliquescent; hence it finds wide application as a drying agent.

Calcium Fluoride. CaF_2. Starting-point in the preparation of other fluorine compounds; used extensively as a flux. See FLUORITE or FLUOR-SPAR.

Calcium Hydroxide. $Ca(OH)_2$. Made by treating lime with water. It is used for various purposes; for mortar, purifying gas, preparation of bleaching-powder, removing the hair from hides, etc.

Calcium Oxide. CaO. LIME. Made by heating limestone; soluble in water and the common acids. When exposed to the air it takes up the moisture and carbon dioxide, and thus becomes air-slaked.

Calcium Phosphates. Tertiary or normal calcium phosphate, $Ca_3(PO_4)_2$, is found in nature as APATITE and PHOSPHORITE (q.v.). It is one of the chief constituents of animal bones. Not soluble in water, but can be converted into a soluble form by treatment with sulphuric acid. Its principal use is for the manufacture of artificial fertilizers. Secondary calcium phosphate, $CaHPO_4,+2H_2O$, is sometimes found in guano, and made by treating a solution of a calcium salt with secondary sodium phosphate. Primary calcium phosphate, $CaH_4(PO_4)_2$, is soluble in water and used extensively as a fertilizer. Made by treating the normal phosphate with sulphuric acid. The mixture of this phosphate and calcium sulphate is sold as "superphosphate of lime," as an agricultural.

Calcium Phosphide. Ca_3P_2. Made by passing phosphorus vapors over heated lime. Treated with water it yields phosphine.

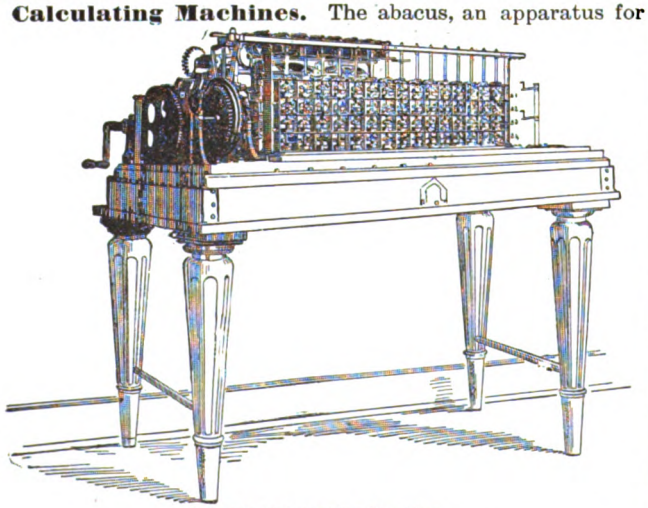
Calcium Silicate. $CaSiO_3$. Found in nature as a white crystalline substance. It is a constant constituent of glass. See WOLLASTONITE.

Calcium Sulphate. $CaSO_4$. Found abundantly in nature as ANHYDRITE and GYPSUM (q.v.). Gypsum contains two molecules of water, which it loses on being heated, forming a fine white powder, which when treated with water absorbs it and hardens; hence it is used extensively for hard finish of walls, molding figures, etc., under the name of plaster of Paris or plaster.

Calcium Sulphide. CaS. Made by heating calcium sulphate with charcoal. It is phosphorescent, and is used in the manufacture of objects that are luminous in the dark, match-boxes, clock-faces, etc.

Calc Sinter, or CALC TUFA. Loosely aggregated concretionary mass of calcite, deposited by evaporation from calcareous waters. See TRAVERTINE.

Calculating Machines. The abacus, an apparatus for



Scheutz Calculating Machine.

counting, has been known from a remote antiquity. Many devices and machines for multiplication have been proposed, as by Plato, Pascal, and Leibnitz. Napier's bones and Gunter's scale were invented for the purpose of abridging numerical operations. An elaborate machine, planned by Babbage 1822 to perform all kinds of numerical operations, was begun by the English government, but never completed. Calculating machines have not come into general use, on account of the skilled labor required to operate them, as well as on account of their high cost. A machine built by Scheutz in Denmark is owned by the Dudley Observatory at Albany, N. Y., which can calculate tables to fifteen places of decimals. Webb's adder is a simple apparatus for adding a column of figures none of which exceeds 100. Auchincloss's averaging machine is a scale on which weights can be moved to perform computations in the equation of payments. Thacher's calculating machine is a series of slide rules arranged in cylindrical form, and is useful when only four places of figures are required in a product or quotient.

Calculi. Concretions of various kinds which occur occasionally in the hollow organs and canals of the body. Disease of the organs acts as predisposing cause, and in the case of bladder stones limestone waters seem to produce them. In the bladder they are composed of ammonio-phosphates of lime and magnesia, oxalate of lime, uric acid, and rarely of cystine; in the kidneys, of uric acid or oxalate of lime; in the gall bladder, of cholesterine; occasionally in the salivary ducts and nasal passages, of phosphate and carbonate of lime; in the appendix cœcum, of fæces, sometimes covered with carbonate and phosphate of lime and of albuminous mucus.

Calculus. Group of operations in the same general field, as Calculus of Radicals, and of Numbers.

Calculus, DIFFERENTIAL. This considers the simultaneous changes of related quantities at an instant. To reach the instantaneous change, various theories have been held: that of indefinitely small quantities, called "infinitesimals"; that of "rates of change"; that of "limit," as the change in one element approaches zero. They give substantially the same results. The formal beginnings of the Differential Calculus were made, probably independently, by Newton in England and Leibnitz in Germany ab. 1670–75. The first adequate systematic statement was by Euler 1755. In recent discussions the terms and notation of Leibnitz are used, while the theories and processes of Newton are dominant. Newton called his analysis "Fluxions."

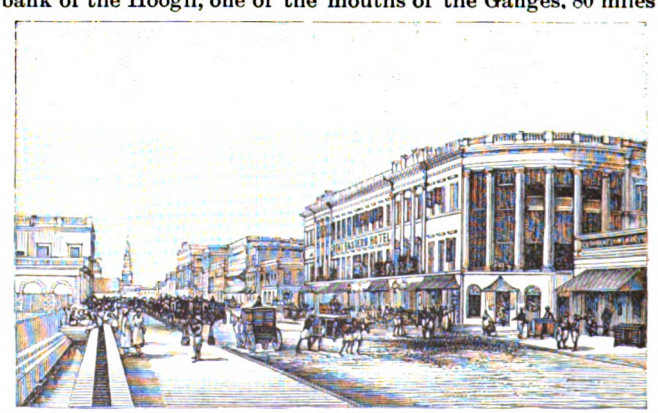
Calculus, INTEGRAL. Complement of Differential Calculus. It seeks to determine from given differential elements and relations the functions from which these arose. It has a wide application in the measurement of lines, areas, and volumes, and in physical problems. While all functions may be differentiated, integration presents some of the most puzzling problems in mathematics, and is not always possible with present knowledge.

Calculus OF FINITE DIFFERENCES. This deals with the ratios of simultaneous changes in quantities mutually related. The Differential Calculus deals with the limits of such ratios, as one element of the ratio approaches zero.

Calculus OF OPERATIONS. This investigates and discusses the genesis of functions as produced by general forces.

Calculus OF VARIATIONS. This deals with indeterminate functions and seeks to determine the change in a derived function resulting from an arbitrary change in the primitive function.

Calcutta. Capital of Bengal and of British India, on e. bank of the Hoogli, one of the mouths of the Ganges, 80 miles



Old Court House Street, Calcutta.

from the sea. It is irregularly laid out in a low, malarious region, and has been extremely unhealthy for Europeans, a condition from which it is emerging. It has a very large com-

merce, receiving nearly all the produce of the country on the Ganges and Bramapootra, and shipping it by sea. Fort William was built here 1696 with factories of the E. India Co. In 1756 the place was taken and sacked by Surajah Dowlah. See BLACK HOLE. In 1757 it was retaken by the British under Clive. It contains several colleges, and a university founded 1857 and attended by nearly 3,000 students. Pop., 1891, including suburbs, 840,130, of whom ab. 20,000 are Europeans.

Caldara, ANTONIO, ab.1670–ab.1736. Italian composer of opera and ch. music.

Caldas Barbosa, DOMINGOS, 1740–1800. Portuguese poet, b. in Brazil of a slave mother.

Caldecott, RANDOLPH, 1846–1886. English artist and illustrator.

Caldera. Warm spring (Spanish).

Calderon, SERAFIN ESTEBANEZ DE, 1801–1867. Spanish novelist and poet. *Christians and Moors*, 1836.

Calderon de la Barca, PEDRO, 1600–1681. Spanish dramatist, author of some 400 plays, of which 120 survive, besides 72 Autos Sacramentales. He became a priest 1651, wrote in all dramatic styles, and was the rival and successor of Lope de Vega in the Spanish theater.

Calderon y Beltran, FERNANDO, 1809–1845. Mexican lyric poet and dramatist.

Calderwood, DAVID, 1575–1650. Scottish divine. His *Altar of Damascus*, 1621, was highly valued by Presbyterians. He left a MS. *History of the Kirk*, pub. in 8 vols. 1842–49.

Calderwood, HENRY, LL.D., b. 1830. Prof. Univ. Edinburgh since 1868. *Philosophy of the Infinite*, 1854; *Parables*, 1880.

Caldwell, GEORGE CHAPMAN, Ph.D., b. 1834. Prof. Chemistry in Cornell 1868. *Agricultural Chemical Analysis*, 1869.

Caleb. Son of Jephunneh, who, with Joshua, encouraged Israel to enter Canaan, when their ten fellow-scouts opposed it.

Caledonia. Roman name for the country n. of the Wall of Antonine. It was first used by Lucan (d. 65) and Pliny, and came to designate the whole of Scotland.

Caledonian Canal. Across Scotland s. w. from Inverness through a chain of lochs to the Atlantic. Its whole length is 61 m., of which 23 are artificial. It is navigable for ships of 600 tons.

Calendar. Method of distributing time into epochs adapted to the purposes of life, such as years, months, and days. Many different systems have been and are now employed, all of which are based in some manner on the motions, real or apparent, of the earth, sun, and moon. As these motions are not commensurable, it is impossible to form a perfect calendar.

Calendar, GREGORIAN. The true length of the year is 365d. 5h. 48m. 47.8s.; the Julian year is therefore too long by 11m. 14s., or a little more than 3 days in 400 years. Accordingly, in 1582, Pope Gregory XIII. introduced the following changes: the error of 10 days, which had accumulated since the Council of Nice, was corrected; and it was provided that for the future all centenary years not divisible by 400 should be common years of 365 days. (The year 1900 is divisible by 4, but not by 400. It will therefore be counted as a common year of 365 days.) The outstanding error will amount to one day only after the expiration of 3,323 years.

Calendar, HEBREW. A so-called lunar calendar, the more important unit being the month, the mean value of which is assumed to be 29d. 12h. 44m. $3\frac{1}{3}$s. The year always contains 12 or 13 months, the length of the month being alternately 29 and 30 days, subject to adjustment by a somewhat complex system. The mean length of the year is 365d. 5h. 55m. $25\frac{25}{57}$s. The actual year of 12 months may contain 353, 354, or 355 days; the embolismic year of 13 months may contain 383, 384, or 385 days. The calendar dates from the creation of the world, assumed to be 3,760 years and 3 months B.C.

Calendar, JULIAN. Established by Julius Cæsar 46 B.C., and made official for the Church at the Council of Nice A. D. 325; still used where the religion is that of the Greek Church. The year is assumed to consist of $365\frac{1}{4}$ days. A common year contains 365 days, and a leap year, *i.e.*, any year divisible by 4, 366.

Calendar, MOHAMMEDAN. Lunar, the year consisting of 12 lunations, the months beginning with new moon, approximately. The length of the year may be 354 or 355 days, the mean is $354\frac{11}{30}$.

Calendar OF SAINTS. Catalogue of such men and women as have been judged by the R. C. Ch., especially the Pope, to be certainly in Heaven, and capable, if invoked, of interceding effectually with God for the faithful; this declaration being their Canonization, or, if of only local effect, their Beatification.

Calendar, ROMAN. This formed the basis of the calendars used in European countries. Before the reformation by Julius Cæsar the method was cumbersome, inconvenient, and subject to considerable uncertainty. These difficulties were obviated by the adoption of the Julian Calendar 46 B.C.

Calendarium. Ancient calendar, on the four faces of a shaft, with the zodiacal signs, length of days, and astronomical and agricultural information.

Calendering. Process of giving finish by pressure to the surface of linen, cotton, or other textiles. The material is passed between heated cylinders, or calenders, which revolve under great pressure. The machine, greatly improved in modern times, was originally introduced by the Huguenots.

Calends. In ancient Roman calendar, first day of each month.

Calendula. Genus of showy-flowered herbs of the Composite family, natives of warm parts of the Old World, and planted for ornament.

Calendula officinalis.

Calenture. Delirium at sea in the tropics.

Calfa, GUY AMBROISE, PRINCE OF LUSIGNAN, b. 1830. Armenian lexicographer and translator.

Calhoun, JOHN CALDWELL, 1782–1850. M. C. 1811, Sec. of War 1817–25, Vice-Pres. 1825–32, U.S. Senator 1832–43 and 1845–50, Sec. of State 1844–45. He was an ardent champion of the South and of the slave system, and the leading advocate of the doctrine of Nullification, by which each State claimed the right of rejecting any act of Congress which it considered unconstitutional.

Caliber. Diameter of the bore of a firearm; a convenient measure in gunnery to designate the gun and the relation of its more important dimensions.

Calibration. Process applied to any graduated measuring instrument by which the value of each division on the scale is known in terms of the quantity measured; *e.g.*, if a galvanometer were calibrated every division on the graduated arc would indicate a known number of amperes of current. When a graduated tube is calibrated its volume between successive marks is known, and perhaps its cross-section at every point.

Calice. See CALYCLE.

Caliche. Spanish name for soda niter or Chili saltpeter.

Calico Bush. See LAUREL, MOUNTAIN.

Calico Printing. This art can be traced to 2,000 years before the Christian era, the oldest known coloring matter being probably indigo. The name calico is derived from Calicut, in India, whence it was first imported into England 1627, was first manufactured in Switzerland 1689 and in 1746 at Mulhouse, France. The principal countries in order of importance engaged in the industry are England, U. S., France, Germany, Switzerland, Austria, and Russia.

The most primitive way of partially dyeing cloth was by previously binding it with cord. In those places where most firmly tied the color would not penetrate, and the result was a calico of a simple pattern of dyed and undyed spots. Next came the "resist," in which some substance such as pipe clay, wax, etc., was applied, which would prevent the cloth from absorbing the dye and thus leave a colored cloth with uncolored figures. This led to block printing, in which the dyestuff was applied by the "block," a smooth piece of wood or metal which had the design cut or etched upon it. This was dipped into the color, the excess removed, and then pressed upon the cloth either by hand or press. The "Perrotine" was the most noted of block presses. Next came the roller printing-machine. In this the design is etched or cut in a smooth copper roller, each color requiring an individual roller. The largest machines have twenty rollers and can produce a design of twenty tints; usually four to six are used.

In the calico printing machine the cloth enters the machine already bleached and singed, being backed by a piece of unbleached material and a blanket. The latter prevents injury to the etched roller from friction and aids the cloth in absorbing the dye. The rollers through which the cloth passes consist of the one with the design and a smooth roller working

parallel to it, which furnishes the pressure. From the first set the cloth passes to others similarly arranged, until the entire figure has been produced. The dye is applied by a color roll which works both against the etched roll as well as in the color pan. The dye is thickened with boiled starch, dextrine, and various gums. The excess of dye is removed from the printing roll by a blade known as the "color doctor." It is next printed, and any loose lint which the roll may have gathered is removed by means of a flat blade known as the "lint doctor." When completely printed the cloth receives such treatment as is needed for the fixation of the various colors.

Of the operations involved in calico-printing some are peculiar to certain styles only, while others are common to all. Patterns are produced in various "styles," among which are the following: 1. Madder Style—in which the mordant, such as aluminium acetate, ferrus acetate, etc., is printed in design and the color later developed in a dye-bath of madder, logwood, etc. 2. Padded Style—in which the cloth is uniformly dyed all over with one color and a design of some other color printed upon it. 3. Steam Style, or surface printing—the color is printed with the mordant or fixing agent, and rendered fast by steaming. Among these are mineral and aniline colors, aniline black, lake and pigment printing. Egg and blood albumen are often used as the fixing agent in steam colors, the albumen being rendered insoluble by the action of steam. 4. Resist Style, or "reserved" style—in which a substance is printed which prevents color from entering the yarn where it is applied. 5. Discharged Style—in which the dyed cloth is printed with a substance which removes the dye.

Another class of dyes are developed by printing one colorless salt and then subjecting the whole to a process of reduction, oxidation or precipitation of that salt, forming a colored compound. Among these may be mentioned manganese brown, chrome yellow, iron buff, and aniline black.

Calicut, or KOLIKOD. Town on w. coast of India, lat. 11° 15′ n.; visited by Vasco da Gama 1498; unsuccessfully assailed by the Portuguese 1509–10, who afterward obtained possession by treaty; taken by Hyder Ali 1766; ceded to England 1792; once famous for cotton-weaving, whence the word calico. Pop., 1891, 65,700.

California. One of the Pacific States; area 158,360 sq. m. Its middle is a great valley stretching from n. to s., parallel to the Pacific Coast. West of this valley is the Coast Range, and on the east is the Sierra Nevada, which separates it from the deserts of Nevada, reaches an elevation in its s. part of nearly 15,000 ft., and at the s. end sweeps around and joins the Coast Range. Further s. the country is broken with irregular hills and low mountains, falling to the eastward into the Mohave and Soda Lake deserts, which extend to the Colorado River.

The industry which settled C. was gold-mining. With the exhaustion of its placers came the discoveries of quartz-mines and cement-deposits, and hydraulic mining took the place of the primitive methods of placer-mining. As these mines have come to yield less freely, agriculture, and particularly the raising of cereals, have become of far greater relative importance, while in the south the production of wine and the raising of tropical fruits have become an industry of great importance. Its railway system is well developed; 4,336 m. were in operation in 1891.

The coast of Lower C. (Mexican), was discovered 1534 by Mendoza and Grijalva, two companions of Cortez. In 1542 the coast of Upper C. was explored as far as Cape Mendocino by Cabrillo; in 1578 Sir Francis Drake coasted along its shores and reached a point as far north as 48° n. lat. The Jesuit missionaries established permanent missions in Lower C.; in 1767 they were expelled by the King of Spain and their possessions turned over to the Franciscan monks, who established numerous missions in Upper C.

When Mexico became independent of Spain, C. was included in its dominion; already a considerable trade had sprung up with the Atlantic States, carried on by vessels making the voyage around Cape Horn. The possession of C. by the U. S. was effected partly by a bold stroke of policy. The attention of the country had been called to it as a desirable accession, and in 1846 Gen. Fremont, while engaged in C. in a scientific expedition, by verbal instructions from the Government, it is supposed, called his men together and counseled a declaration of independence. A day or two preceding Fremont's move a U. S. frigate had arrived at Monterey, hoisted the U. S. flag, and declared by proclamation of its commander that C. was a part of the U. S. Some fighting with the natives followed, but the country was pacified in a few months, and at the close of the war then waging with Mexico over the accession of Texas, a treaty was signed ceding to the U. S. all of Upper C., in addition to New Mexico, Arizona, and Utah.

This cession was almost immediately followed by the news of the discovery of gold, which brought settlers into the Territory from all directions.

Discussion in Congress as to what should be done with C. began two years before its acquisition. The conflict was intense over the question of slavery, and continued for some time after the cession. In 1849 the people of the Territory framed a constitution in which slavery was prohibited, and in 1850 it was admitted as a State. The capital is Sacramento, and the chief city San Francisco. Pop., 1890, 1,208,130, of whom 366,309 were of foreign birth, and 12,355 were Indians.

California, GULF OF. Arm of the Pacific, between Mexico and Lower C.

California, LOWER. Peninsula of Mexico, between the Gulf and the Pacific, ab. 750 m. long, 30 to 150 m. wide; first visited by Europeans 1534. Area 58,328 sq. m.; pop., 1890, 31,167.

California Jack. Game usually played by two or four persons with a pack of 52 cards, which rank as in whist. The game is usually ten points, and the points score in the following order: 1. *High*, the ace of trumps. 2. *Low*, the deuce of trumps. 3. *Jack*, the knave of trumps. 4. *Game*. It is similar to All-Fours. After dealing six cards to each and cutting for a trump card, the pack is turned face up and the winner of a trick takes the top card, the others following him. The points go to the player who takes them in playing.

California, UNIVERSITY OF. Chartered at Oakland 1868; transferred to Berkeley 1873; successor of the College of Cal., which was founded 1855 at Oakland, opened 1860, and graduated classes till 1869. In addition to the Colleges of Letters, Social Sciences, Natural Sciences, Mechanics, Mining, Civil Engineering, and Chemistry, it has connection with the State Agricultural College, the Lick Astronomical Observatory at Mount Hamilton, and Colleges of Law, Medicine, Dentistry, and Pharmacy at San Francisco. It has (1895) a total of 133 members of the various faculties, with 1,000 undergraduate students at Berkeley, ab. 700 more in the professional schools, and a library of 56,000 vols. It is supported in part by a State tax.

Caligula, 12–41. Third Roman emperor, son of Germanicus and Agrippina. His real name was Caius Cæsar; he was nicknamed Caligula (little boots) when a boy by the soldiers. He was believed to have hastened the death of Tiberius; came to the throne 37, and reigned justly a few months, but afterward as a cruel and licentious madman; exhausted Italy by extortions, and plundered Gaul; built a temple to himself as Jupiter Latiaris, and was murdered.

Head of Caligula.

Caliph, or KHALIF. Title assumed by those who after Mohammed exercised temporal and spiritual authority over his followers. The principal caliphates are: (1) that of the East, founded by Abu-Bekr at Mecca, and transferred to Bagdad by the Abassides 632–1258; (2) that of Cordova, founded by Abdurrahman I. 756–1031; (3) that of Egypt under the Fatimites 909–1171. The caliphates of Persia and Turkey date from 1502 and 1517.

Calisaya Bark. See CINCHONA.

Calisthenics, or CALLISTHENICS. Gentle gymnastics, adapted to girls.

Calixtines. More moderate followers of Huss, content to yield much to Rome, if allowed the communion in both kinds; opposed to the more violent Taborites.

Calixtus I. Bp. of Rome 219–223. He had a controversy with HIPPOLYTUS (q.v.).—II. Guido of Vienne, Count of Burgundy, pope 1119–24. He excommunicated Henry V. 1119, and ended the contest about investitures nearly on his own terms 1122.—III. Alfonso Borgia, b. 1379, pope 1455–58.—Also an antipope 1168–77.

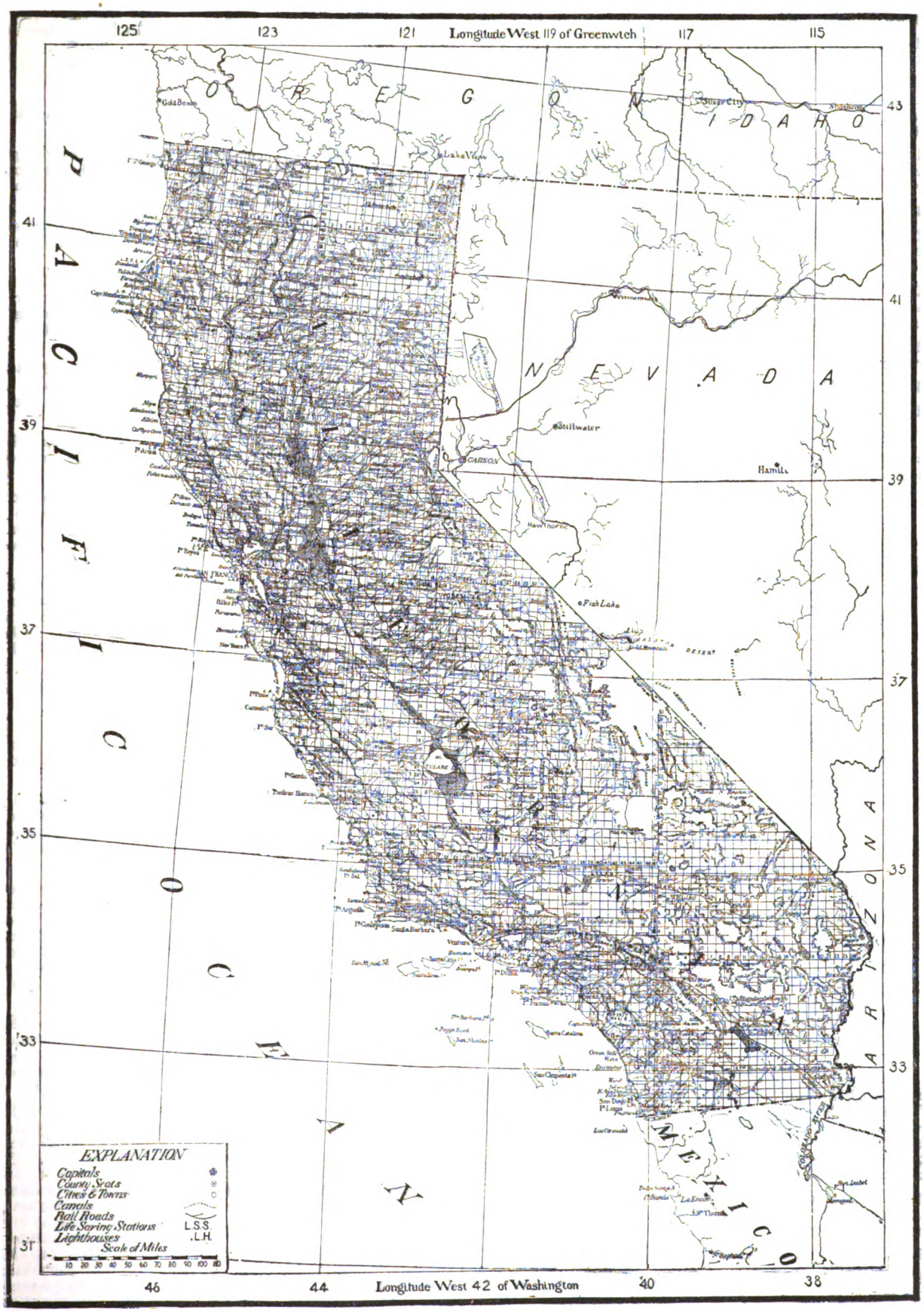
Calixtus, or **Kallisen,** GEORGE, 1586–1656. German divine of views and temper too liberal for his age; he tried to mediate between Lutherans, Calvinists, and Catholics, and in consequence was suspected and disapproved by all; prof. at Helmstedt from 1614. He was the first to separate ethics from dogmatics.

Calk. See BARITE.

Call. Signal given by drum or bugle, to announce an intended movement in military evolutions, or to assemble troops for drill or parade.

Call, RICHARD KEITH, 1791–1862. Gov. of Florida 1835–40 and 1841–44.—His nephew. WILKINSON, b. 1834, has been U. S. senator from Fla. since 1879.

Calla. *Richardia Æthiopica.* Large plant of the natural family *Araceæ*, native of e. Africa; cultivated as a house-plant,


Longitude West 119 of Greenwich
Longitude West 42 of Washington
OREGON
IDAHO
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
Gold Beach
Lake View
Silver City
Winnemucca
Stillwater
CARSON
Hawthorne
Fish Lake
Hamilton
SAN FRANCISCO
TULARE
Santa Barbara
Ventura
San Clemente
EXPLANATION
Capitals
County Seats
Cities & Towns
Canals
Rail Roads
Life Saving Stations L.S.S.
Lighthouses L.H.
Scale of Miles
10 20 30 40 50 60 70 80 90 100 110

C. palustris is a small plant of the same family, inhabiting cold bogs in the n. hemisphere.

Callainite. $Al_4P_2O_{11}+5aq$. Natural hydrous aluminum phosphate, supposed to be the mineral called Callais by Pliny.

Callao. Chief seaport of Peru, 6 m. w. by s. of Lima; rebuilt 1746. Pop. ab. 35,500.

Callcott, JOHN WALL, 1766–1821. English composer chiefly of glees and catches. He studied with Haydn 1790. *Musical Grammar*, 1806.—His brother, SIR AUGUSTUS WALL, 1779–1844, knighted 1837, was an eminent landscape-painter.

Callicrates, ab. 444 B.C. Greek architect and sculptor, said to have invented the Corinthian capital, suggested to him by observing an acanthus overgrowing a basket.

Calligraphic Etching. See ETCHING.

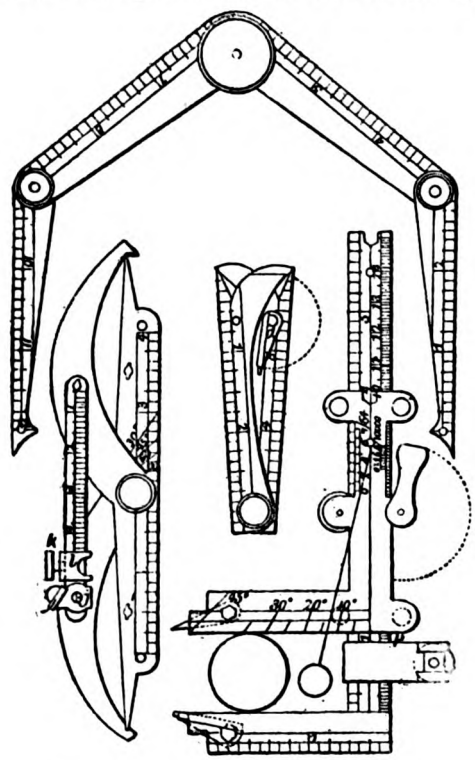
Callimachus, b. ab. 540 B.C. Greek architect and sculptor, said to have originated or more probably developed the Corinthian capital.

Callimachus, d. ab. 240 B.C. Critic, grammarian, and poet of Alexandria, where he was chief librarian of the museum. We still have hymns, epigrams and portions of elegies from him.

Callinus, ab. 700 B.C. Greek poet of Ephesus, earliest writer of elegies.

Calliope. Muse of epic poetry.

Callipers. Instruments used for measuring diameters of rods and cylinders in machinists' work. The ordinary ones are like a pair of dividers with the legs curved outward, so that the points may touch the work at opposite ends of a diameter. The distance between the points can then be measured by a scale.



Callipers.

For exact work and manufacturing in quantities, GAUGES (q.v.), are often used instead. These may be standard gauges or simply templates of thin metal. For fine measurements a micrometer or vernier calliper may be used. These instruments read to the one-thousandth of an inch from a fixed or adjustable zero by the method which their name indicates.

Callisthenes, d. 328 B.C. Thracian comrade of Alexander, a history of whose exploits is doubtfully ascribed to him; fragments only survive.

Callisthenics. See CALISTHENICS.

Callistratus. (1) Athenian orator, d. ab. 360 B.C. (2) Supposed author of the hymn in honor of Harmodius and Aristogeiton, often tr.

Callography. Generic term applied to all the reproductive processes among the Graphic Arts, when the printed impression, in permanent ink, is obtained from a gelatinous film, which, after suitable treatment, receives the image from a photographic negative, and is capable of yielding, on the printing-press, many prints of commercial and artistic value. Many names are given to the results obtained from the gelatinous base, as Albertype, Heliotype, and Indotint. See PHOTO-GELATINE.

Callorhinus. See OTARIADÆ.

Callosity. See ISCHIAL CALLOSITY.

Callot, JACQUES, 1594–1635. French genre artist, best known by his etchings.

Callus. Vegetable tissue formed by the renewed growth of cells, whose maturity has been reached, on being wounded, as in cutting or bruising a stem. A similar tissue forms normally in the sieve-plates during periods of repose.

Callus. Material exuded between and around the ends of broken bones, by means of which they unite, it being converted into true bone.

Calm. Absence of wind. Total absence is called a dead calm. When anemometers are used, a velocity too small to call for record appears as a calm; the corresponding limiting velocity therefore depends on the delicacy of the instrument.

Calmar, UNION OF. Act passed 1397 at Calmar in Sweden, by which Sweden, Denmark, and Norway agreed to be henceforth under one sovereign, who should govern each according to its respective laws and customs.

Calm-Belt. Region such as that under the equatorial belt of low pressure, or under the tropical belts of high pressure, where calms or light baffling winds prevail.

Calmet, AUGUSTIN, 1672–1757. Benedictine monk 1689; abbot of Nancy 1718, and of Senones, in his native Lorraine, 1728. *Commentary*, 23 vols., 1707–16; *History of Lorraine*, 1728. His *Dictionary of the Bible*, 1722–28, tr. 1732, was long and highly valued.

Calmucks, or KALMUCKS. Mongolian race, found in central Asia and s. Russia; nomadic in their habits, and mostly adherents of Lamaism. They entered Russia 1758, but in 1771 a large body of them went back to China. Russia in Europe has ab. 110,000, of whom many are Buddhists; Asiatic Russia, ab. 55,000; China an unknown number.

Calomel. Hg_2Cl_2. Mercurous chloride; found as a native mineral associated with cinnabar. It is used as a cathartic, especially when a very thorough effect is desired.

Calonne, CHARLES ALEXANDRE DE, 1734–1802. French financier, who, by heavy taxes and lavish borrowing, helped to bring on the Revolution; banished 1787.

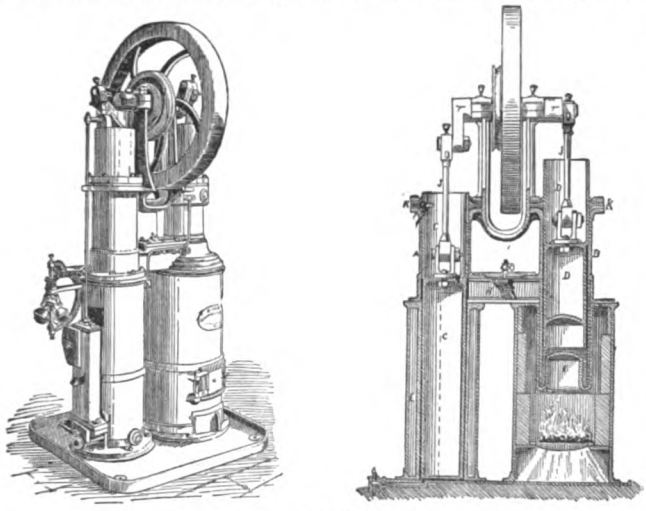
Calophyllum. Genus of trees of the natural family *Guttiferæ*. Some species produce timber resembling mahogany, others medicinal resins. The fruit of most are edible and from which an oil is expressed, used in lamps. Natives of warm climates.

Calorescence (CALOR). When a beam of radiant energy is passed through a solution of iodine in bisulphide of carbon, all non-luminous rays are absorbed; but if the transmitted radiation be brought to a focus by a lens, a piece of platinum may be rendered luminous and become a source of radiation for rays of all lengths. If the light emitted by the platinum be examined by a prism, it will give a continuous spectrum. Prof. Tyndale investigated and named this phenomenon.

Caloric. Quantity of heat necessary to raise one kilogram of water one degree Centigrade. The British thermal unit equals 0.251996 of the French caloric, or the B. t. u. for a pound of water is $\frac{5}{9}$ of the French caloric to the kilogram. Conversely, the caloric is 3.968 B. t. u.

Caloric Engine, or HOT-AIR ENGINE. One in which the motive power is supplied by the expansion of air by heat. A given volume of air is brought in thin sheets into contact with heated metal, and is instantly expanded by that heat. This expansive force is exerted against a piston to drive it outward. When the outward stroke is completed, the air is either exhausted, or, better still, is transferred to a cooling-jacket where its heat is withdrawn, and its volume diminished, so that atmospheric pressure may become greater than the inside pressure, and help to carry the working piston inward again. Most of the caloric engines have two cranks at 90° with each other, so that the phase of the cranks may so influence the pistons as to give the maximum effect to the increase and decrease of volume of air. The best known are Stirling's, Wilcox's, Roper's, Shaw's, Ericcson's, Belou's, Laubereau's, Rider's, and Merrill's. In some of them the products of the combustion of the fire have been passed through the cylinder; in one the pressure of the air is

kept up by compression above two atmospheres. One great limitation of the caloric engine is the fact that for large powers



Rider's Hot-Air Engine.

it becomes of great weight and bulk. Their theoretical efficiency is less than 50 per cent. See GAS ENGINE.

Calorific Power. Capacity of a body to give off heat when rapidly combined chemically with oxygen, or burned. It is an exact measure also of the amount of heat necessary to decompose the combination with oxygen. The following table gives the calorific power of a number of the ordinary combustibles in British thermal units.

Combustible.	Cal. Power.	Ref. letter.	Combustible.	Cal. Power.	Ref. letter.
Hydrogen (H)	62,000	a	Graphite	14,035	a
Marsh Gas (CH_4)	23,513	a	Coke	12,600	b
Olefiant Gas (C_2H_4)	21,344	a	Lignites	12,240	b
Petroleum	21,000	b	Peat	9,000	b
Turpentine	19,533	a	Peat (20 per c. H_2O)	7,200	b
Spermaceti	18,616	a	Dry Wood	7,200	b
Ord. Ill. Gas	18,000	b	Wood (20 per c. H_2O)	5,600	b
Ether	16,250	a	C to CO	4,466	a
Anth'cite Coal, Fr'ch	15,689	b	CO to CO_2	4,325	a
Carbon	14,544	a	Sulphur	3,966	a
Anthracite Coal, Pa	14,414	b	Iron Furn. Gas	1,620	b
Bitu. Coal, mean	14,400	b			

(a) From experiments of Favre and Silberman.
(b) Calculated from Morin and Tresca.

Calorimeter. Apparatus used in tests of boilers to determine the percentage of water entrained with the steam in the steam-pipe. The most usual is the barrel calorimeter proposed by Hirn. A barrel containing a known weight of water at an observed temperature stands on a scale platform. Steam is blown into the water through a hose from the steam-pipe where the observation is to be made until a given weight is condensed, and the new temperature is observed after the water has been stirred. Then from either of two formulæ, $U=Hx+(W-x)h$ or $U=Wh+Lx$, the per cent of steam in the sample added to the barrel can be determined. In these formulæ, U = total heat units imparted to water; H = heat units imparted per pound of steam; h = heat units imparted per pound of water; W = weight of steam and water added to the barrel; x = weight of steam alone, and L = latent heat of steam at the pressure used. Such devices give unreliable results, except in the most careful hands, showing wide variations where none exist. The continuous calorimeters proposed by Van Buren, Skeel, Hoadley, Kent, and Barrus avoid several elements of uncertainty in the barrel method. The term is also applied in boiler practice to the aggregate area of the openings in the tubes through which the hot gases pass.

Calorimotor. Form of galvanic cell devised by Dr. Hare of Phila., in which the internal resistance is reduced to a minimum. In one form large sheets of copper and of zinc, separated by a layer of cloth, are rolled into a cylinder. Ordinarily a few large plates of zinc, connected together, are combined with a few large copper plates, also connected. When the plates are immersed in acidulated water, the calorimotor, owing to its low internal resistance, gives a large current, and is capable of remarkably powerful heating effects.

Calottistes. Society of wits in the time of Louis XIV.; named from the Calotte (skull-cap), which they invited the objects of their satire to wear; dissolved by Fleury ab. 1720.

Calotype. Photographic process invented by Dr. Fox Talbot 1840; since known as the TALBOTYPE (q.v.).

Calovius, or Kalau, ABRAHAM, 1612–1686. Lutheran theologian, prof. at Königsberg 1637 and Wittenberg 1650; opponent of CALIXTUS (q.v.), whom he accused of SYNCRETISM (q.v.).

Caloyers. Monks of Greek Ch.

Calpee. Town of India; taken by Sir Hugh Rose after defeating the Sepoys, May 22–23, 1858.

Calpurnius Siculus. Roman pastoral poet, imitator of Virgil and Theocritus.

Calthrops. Sponge spicules with four rays, so placed that any three being used for a tripod support, the fourth points upward; present in the genus *Theonella*.

Caltrop, or CROW'S-FOOT. Sharp four-pronged piece of iron, formerly scattered to check an attack by cavalry.

Caltrops. *Tribulus terrestris.* Low plant of the natural family *Zygophyllaceæ*, with spiny fruit; native of the Old World, introduced into America.

Caltrop.

Caltrops, WATER. See CHESTNUT, WATER.

Calumba, AMERICAN. *Frasera Carolinensis.* Herb of the Gentian family, native of the s. e. U. S., with an exceedingly bitter root.

Calumba Root. *Jateorhiza Calumba.* Climbing shrub of the Moonseed family, bearing large roots of officinal repute, native of the e. coast of Africa. The False Calumba (*Coscinum fenestratum*) of the same family is a native of Ceylon.

Calumet. Peace-pipe used by Indians after signing a treaty. The bowl is usually of red soapstone, and the stem of reed or painted wood, ab. 2½ ft. long.

Calvaert, DENIS, 1555–1619. Flemish painter.

Calvary. Place of Our Lord's crucifixion; possibly the skull-shaped eminence near Jeremiah's Grotto; often represented in R. C. devotions.

Calverley, CHARLES STUART, 1831–1884. English poet and translator. His *Fly Leaves*, 1872, contain some excellent humorous verse. *Literary Remains*, 1885.

Calvert, FREDERICK CRACE, 1819–1873. English chemist who succeeded in making known the disinfecting value of carbolic acid. *Dyeing and Calico-printing*, 1878.

Calvert, GEORGE. See BALTIMORE, LORD.

Calvert, GEORGE HENRY, 1803–1889. American dramatist, poet, and journalist, descended from Lord Baltimore.

Calvert, LEONARD, ab. 1606–1647. Gov. of Md. from 1634; brother of Cecil, Lord Baltimore.

Calvi. Seaport of Corsica, surrendered to the British Aug. 10, 1794, after 59 days' siege; retaken 1795.

Calvin, JOHN, 1509–1564. French reformer. Driven from Paris, he went to Basel 1535, and in 1541 settled as pastor in Geneva, where he soon became all-powerful, exerting also a wide and deep influence through w. Europe by his books and letters. He was the foremost champion of extreme Protestant orthodoxy, and merciless toward heresy, as in Servetus' case. His works in an incomplete tr. fill 52 vols. Most important are the *Institutes*, 1536–59.

John Calvin.

Calvin, SAMUEL, b. 1840. Prof. Univ. Iowa; State geologist.

Calvinism. System of doctrine developed by St. Augustine, revived by Calvin, and accepted in varying shapes by the Reformed churches of Switzerland, France, Germany, Netherlands, and in England and America by Presbyterians, Congregationalists, most Baptists, and many Anglicans. Starting with the Divine Decrees, it proceeds logically through Effectual Calling to the Perseverance of Saints. It has in all lands and periods provoked vehement controversy, and is now held in modified forms by most of its professed adherents.

Calvinistic Methodists. Sect originating with Whitefield 1741, and now strongest in Wales.

Calycanthaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising two genera and ab. four species, growing in N. America and e. Asia.

Calycanthemous. Sepals colored so as to resemble petals.

Calyceraceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising three genera and ab. 20 species, growing mostly in s. portions of S. America.

Calycifloræ. Polypetalous exogenous plants, bearing the stamens on the calyx.

Calycinal. Pertaining to or borne on the calyx.

Calycle. Whorl of bracts outside the calyx, like an exterior calyx, as in the flowers of the Strawberry.

Calycle, or THECA. Coral cup; circular, radiately ribbed depression in the coral cœnenchyma in which the polyp lives.

Calycophoridæ. Sub-order of Siphonophores, having long stems, but no pneumatophore or dactylozoöids. There is a double row of nectocalyces or one or two large ones (*Diphyes*). Next, on the stem, come regular groups of appendages that can be drawn into the cavity of the nectocalyx. Each group consists of a nutritive polyp, a tentacle provided with kidney-shaped groups of nematocysts, gonophores with sexual cells on the manubrium, and usually the cluster is covered by an umbrella-shaped hydrophyllium.

Calycozoa. See LUCERNARIÆ.

Calydonian Hunt. Mythical pursuit of a wild boar of surpassing size and strength, which Diana had sent to ravage

Calydonian Hunt.

the territory of Calydon. Meleager, Jason, and Theseus had part in it. Out of the quarrel over the head and hide arose a bitter war.

Calypso. Nymph of the island Ogygia, who loved Ulysses and kept him 7 years.

Calypso. Beautiful orchid, *C. bulbosa*, found in cold bogs in the n. hemisphere.

Calypter (CALYPTRA). Hood or cap which surmounts the sporange or capsule of the mosses.

Calyptoblastea, or CALYPTOBLASTICA. See CAMPANULARIÆ. Also termed Calyptoblastea-Leptomedusæ.

Calyptrogen. One of the layers of meristem in the tissues of the roots of plants.

Calyx. Outer of the two floral envelopes in a flower.

Calyx. Body of a Crinoid, or Stone-lily, borne by the stalk.

Cam. In machine design, an organ by which a rotary motion is transformed into a reciprocating one. The rotary motion may be continuous or a rocking motion through a small angle. In this second case the cam is called a "wiper." The usual cam is a non-circular disk rotating round a center, and imparting motion to a rod by pressing its edge against a roller on the end of the latter. Where the weight of the rod cannot be utilized to bring it back to its original position, a side-cam must be used, in which a projecting ledge passes between two rollers on the rod. A roller in a groove is objectionable on account of the wear at the opposite points, when the motion of the roller must be instantly reversed. Cams are much used for moving the valves of large steam engines, in printing-press and sewing-machine work, and in special automatic manufacturing machinery.

Cam, DIOGO. Portuguese explorer, who discovered the mouth of the Congo 1484, and sailed to 22° s. lat.

Camaldolites, or CAMALDULIANS. Order of monks founded 1012 by Romuald, ab. 950–1027, at Camaldoli near Arezzo; removed to Venice 1212.

Camarilla. Courtiers, in Spain and elsewhere, as against ministers of state.

Camarina. Ancient city of s. Sicily, founded from Syracuse 599 B.C.

Camarosaurus. Most gigantic of land animals. A Dinosaur, described in 1878 by E. D. Cope, had both fore and hind limbs well developed, the tail long and large, one dorsal vertebra 3 ft. in diameter, and the femur 6 ft. long; the total length was 80 feet. In the lower cretaceous beds of Dakota was found a similar animal but of more slender build, *Amphicoelias alatus*, which, it has been estimated, could browse from branches 30 ft. high, and in length may have exceeded *Camarosaurus*. A vertebra has been found which was 6 ft. high; this must have belonged to a Dinosaur over 100 ft. long.

Camass. *Camassia esculenta.* Bulbous herb of the Lily family, native of n. w. N. America. Its bulbs are collected by the Indians, to whom it is an important food. It is known as Quamash.

Camayeu. Painting in one color; monochrome.

Cambacérès, JEAN JACQUES REGIS DE, 1753–1824. Chancellor of French Empire 1805, Duke of Parma 1808; exiled 1816–18. His *Project of a Civil Code*, 1796, became the basis of the CODE NAPOLEON (q.v.).

Cambay. Ancient town of w. India, once large and rich, now decayed through partial filling up of Gulf of C. Pop. ab. 36,000.

Camber (OF BRIDGES). Bridges are usually built so as to have a slight upward curve above the horizontal line joining the supports. The object of this curve, or camber, is to prevent the bridge from deflecting below the horizontal line when loaded. The amount of camber at the center of the bridge is usually about one five-hundredth of the span.

Cambiform. Prismatic, thin-walled cells occurring in the fibro-vascular bundles of plants.

Cambist. A person understanding the operations of exchange and the value of foreign moneys. It is a term of great antiquity.

Cambium. Layer of formative tissue immediately under the bark of exogenous plants.

Cambodia. Country of s. e. Asia, s. of Siam. The surface

Cambodian Types.—The Queen Mother.

is level, and is drained by the Mekong R. For centuries an in-

dependent kingdom, it became tributary to Siam ab. 1545, later to Annam, and is now held by France. Area 32,390 sq. m.; pop. ab. 1,500,000.

Cambon, JOSEPH, 1754–1820. Financier of the French Revolution.

Cambray, BATTLE OF. See SPURS.

Cambray, LEAGUE OF. Dec. 10, 1508, between Pope Julius II., the Emperor Maximilian, Louis XII. of France, and Ferdinand of Spain, for the purpose of partitioning Venice.

Cambray, PEACE OF. Treaty between Francis I. and Charles V., negotiated 1529 by Louisa of Savoy, Francis' mother, and Margaret of Austria, Charles' aunt; hence called *Paix des Dames.*

Cambria. Wales; land of the Cimbri or Cymry.

Cambrian. System or series of fossiliferous rocks lying immediately below the Ordovician. The term is derived from N. Wales (ancient Cambria), where some of the strata were first studied by Sedgwick. Much difference of opinion exists as to the extent and subdivision of these rocks; their general relationship is given below. The lowest Cambrian strata contain the oldest undisputed fauna known. Even here, however, we find well represented almost all the groups of Invertebrates. Trilobites are exceptionally well developed. These facts prove a long preceding era, the life of which is totally unknown.

	N. America.	Britain.	Bohemia.	Sweden.
Upper Camb.	Potsdam.		Étage C. of Barrande Primordial Fauna.	Regiones A and B of Angelin and Regio fucoidarum.
	Knox (Tenn.)	Tremadoc Slate.		
	Tonto (Ariz.)			
	Belle I. (Nfd.)	Lingula Flags.		
Mid. Camb.	St. John (N. B.)			
	Braintree (Mass.)	Menevian.		
	Avalon (Nfd.)	Solna.		
Lower Camb.	Georgia (Vt.)	Caerfai Group.		
	Placentia (Nfd.)	Harlech Grit.		
	Prospect (Nev.)	Llanberis Slate.		

Cambric. Finest linen fabric, first made at Cambray, n. France.

Cambridge. Town of England, on the Cam, 50 m. n. of London; chartered 1200; seat of the famous university. Pop., 1891, 36,983.

Cambridge. City of Middlesex co., Mass., on Charles R., closely adjacent to Boston, of which it is in effect a suburb; chiefly noted as the seat of Harvard University, the oldest (founded in 1636) and in most respects the best equipped of American institutions of learning. It has some manufacturing interests and several publishing houses. It was founded as "Newe Town" 1631, incorporated 1633, and chartered 1846. Pop., 1890, 70,028.

Cambridge, ADA. See CROSS, MRS. A. C.

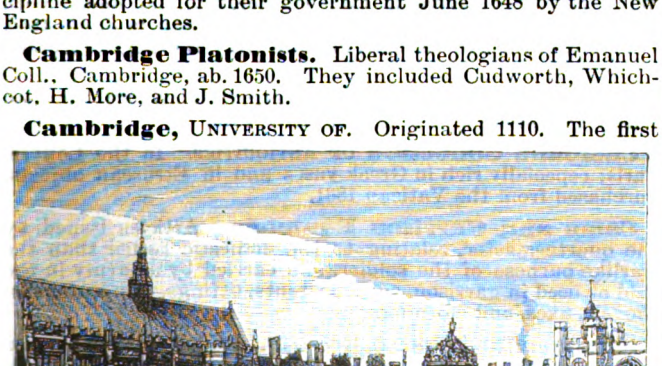
Cambridge Divinity School. Department of Harvard Univ.; founded 1819; undenominational. It has 6 professors and ab. 36 students.

Cambridge Greensand. See CRETACEOUS SYSTEM.

Cambridge Platform. System of Congregational discipline adopted for their government June 1648 by the New England churches.

Cambridge Platonists. Liberal theologians of Emanuel Coll., Cambridge, ab. 1650. They included Cudworth, Whichcot, H. More, and J. Smith.

Cambridge, UNIVERSITY OF. Originated 1110. The first



Large Quadrangle, Trinity College, Cambridge.

college, Peterhouse, was founded 1286, Pembroke 1347, Corpus Christi 1352. It now has 17 endowed colleges and 3 "hostels." The young women in Newnham and Girton colleges are admitted to the Cambridge examinations, but do not obtain degrees. There are ab. 3,000 students. The Univ. library contains over 400,000 vols. and MSS., and some of the college libraries are of high value.

Cambro-Silurian. System or series of rocks formerly called the Lower Silurian; now usually known as Ordovician.

Cambuskenneth. In Scotland, near Stirling; scene of a defeat of the English by Wallace, Sept. 10, 1297.

Cambyses. Second king of Persia, son of Cyrus the Great. He reigned 529–22 B.C.; conquered Egypt 525, and was detested for his cruelties.

Camden. City of Camden co., N. J., on the Delaware opposite Philadelphia. Pop., 1890, 58,313.

Camden, S. C. Scene of two battles of the Revolution. In the first, Aug. 16, 1780, Cornwallis defeated Gates, mortally wounding Baron De Kalb; in the other, April 25, 1781, Greene was repulsed by the English.

Camden, CHARLES PRATT, EARL OF, 1713–1794. Chief-justice of Common Pleas 1762, baron 1765, lord-chancellor 1766–70, pres. of council from 1782, earl 1786.

Camden, WILLIAM, 1551–1623. English antiquary. *Britannia,* 1586. He is commemorated by the Camden Society, founded 1838 to publish old documents bearing on British history.

Camel. Genus *Camelus.* Ruminating animal, with outer upper incisors present and tusk-like, as is also the first premolar. Canine teeth present, upper lip cleft, nostrils closable at will, neck vertebræ long, two toes functional, and with pads and nails. One hump of fat on back of Dromedary (Arabian camel), and two humps on Bactrian species of Central Asia. Stomach has no manyplies, the rumen has water-cells. A camel can travel 300 m. in 5 days without drinking. Color sandy, rarely white, length 10 ft., height 7 ft. Wild camel, supposed to have escaped from owners, is found in Asia and in Arizona. The camel has keen sight and scent, lives ab. 30 yrs., and brings forth one foal at a time. The Arabian camel's load averages 500 lbs., the Bactrian can carry twice the weight, but only for short distances. Its gait is ab. 2½ m. per hour. Some of the camels bred for speed and known as dromedaries travel 100 m. a day. Camels have been successfully imported into Australia for exploration of the interior, and in 1857 the U. S. made a similar successful experiment in New Mexico and Arizona. The Civil War prevented the extension of their use, but camels are still employed in Nevada. See TYLOPA. For American camels see GUANACO, LLAMA, VICUNA.

Camel. Device for floating vessels over shoals.

Camellia. Genus of showy-flowered shrubs of the natural family *Ternstroemiaceæ,* natives of e. Asia, widely cultivated. The Chinese extract an oil from the seeds.

Camelopardellidæ, or DEVEXA. Family of the section *Pecora* of the sub-order *Ruminantia.* The Giraffe, the only living representative, is adapted for feeding upon the leaves of trees by having an extremely long neck and vertical development of the front of the body, which causes the back to slope strongly toward the tail. There are but the normal number (7) of cervical vertebræ. Short, persistent horns, consisting of separate ossifications placed on the sutures between the frontal and parietals, and covered by a hairy skin, exist in both sexes. A central horn of similar nature is placed upon the sagittal suture. There are but two toes to the feet. The animal lives south of the Sahara, and is sometimes 18 ft. high, but is inoffensive. The name Camelopard is due to its being spotted like the leopard and having a long neck like the camel.

Camelot. One of King Arthur's capitals, by some identified with Queen's Camel, Somersetshire. Shakespeare's C. is Tintagel or Camelford in Cornwall.

Camenæ. Roman name for the Nine Muses. It originally designated certain fountain nymphs who presided over childbirth, and had the gift of prophecy.

Cameniata, JOANNES. Greek historian, who wrote on the capture of Thessalonica by the Arabs 904.

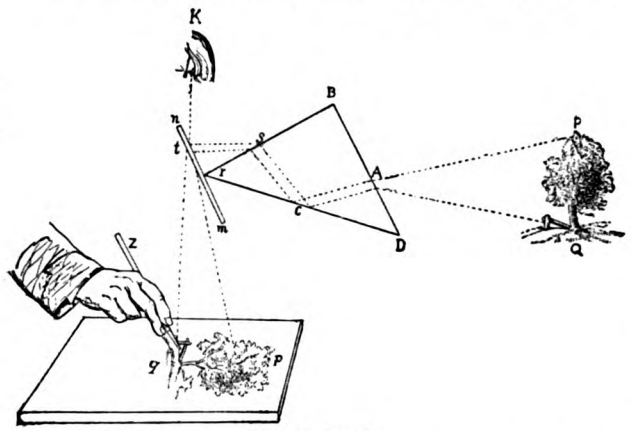
Cameo. Engraved gem in relief, generally cut from a stone like agate or onyx, with layers of different colors, so that the design appears in one or more colors on a background of another color. This art flourished in highest perfection during the Alexandrian period and under the early Roman Empire, but was revived by the Renaissance.

Cameralist. Financier; a person skilled in the principles

and system of public revenue. A term scarcely used outside Germany.

Cameralistics. Science of public finance. This word is almost confined to Germany.

Camera Lucida. Optical instrument depending for its action upon the principle of internal total reflection. By its means the outlines of objects may be traced as projected by the eye upon a sheet of paper. Invented by Wollaston 1804 and improved by Amici. Amici's consists of a triangular glass prism, right angled at B. One of its perpendicular faces is turned toward the object that has to be drawn and the other



Camera Lucida.

side placed at right angles to an inclined plate of glass, *n m*. The dotted lines in the figure show the direction of the rays of light.

Camera Obscura. Instrument invented ab. 1569 by Baptista Porta of Naples. It consists of a dark room or box, into which rays of light from without are admitted through a very small opening. If a screen be placed in the chamber opposite the opening, inverted images of outside objects will be obtained on the screen in their natural colors, but reduced in size. It was soon found that a convex lens placed in such an opening produced a much sharper and, because of the much greater quantity of light admitted, much brighter image. The chief use of the camera at present is for photographic purposes, in which case the screen is replaced by a sensitive plate upon which the image is thrown.

Camerarius, or **Liebhard,** JOACHIM, 1500–1574. Prof. Nuremberg 1526; Tübingen 1535, and Leipzig from 1541. *Life of Melancthon*, 1566. His other works relate mainly to the classics.

Cameron, JOHN, 1579–1625. Scottish theologian, prof. at Saumur 1618, Glasgow 1622, and Montauban 1624; founder of a school that extended the decree of election to all human beings.

Cameron, RICHARD. Scottish field-preacher, killed in a skirmish 1680; founder of the "Cameronians" or Reformed Presbyterians.

Cameron, SIMON, 1799–1889. U. S. Senator fom Pa. 1845–49, 1857–61, and 1866–77; Sec. of War 1861–2; Minister to Russia 1862–3.—His son, JAMES DONALD, b. 1833, has been U. S. Senator since 1877.

Cameron, VERNEY LOVETT, b. 1844. English explorer. *Across Africa*, 1876; *Our Future Highway to India*, 1880; *Gold Coast*, 1883.

Cameron, WILLIAM, 1751–1811. Scottish poet; minister at Kirknewton from 1786; author, in whole or part, of many of the Scotch *Paraphrases*, 1781.

Cameroons. German protectorate (since 1884) on w. coast of Africa, e. of mouth of the Niger. The Cameroon Mts. are at one point ab. 13,750 ft. high.

Camillus, MARCUS FURIUS, 447–365 B.C. Roman general, five times dictator. He took Veii 396 B.C., and defeated the Gauls 390 and 367.

Camisards. Huguenots of Languedoc who resisted oppression, and were killed or exiled 1705; named from the *camisa* or blouse worn in *camisades* or night attacks.

Camoens, LUIS DE, 1524–1580. Portuguese epic and lyric poet. His *Lusiad*, one of the greatest of national poems, was written in India between 1556 and 1569, and pub. 1572; tr. by Mickle 1776. His lyrics were largely the product of his later life, which was spent in poverty.

Luis de Camoens.

Camomile. See CHAMOMILE.

Camorra. Secret society in Naples, whose members terrorized the country, taxing all trades and classes, and committing many crimes. In 1874, 200 of them were exiled.

Camouflet. Military mine containing so small a charge as to produce no crater when exploded. Its object is to destroy an enemy's mine or gallery, or to produce suffocation in the latter.

Camp, WALTER, b. 1859. Member of the Advisory Committee on Athletics at Yale Univ. *Book of College Sports; American Foot-Ball; Foot-Ball Facts and Figures*, 1895.

Camp. Any temporary location for troops in campaign, where, under tents or improvised shelter, they may sojourn for a brief period; when without shelter they are said to be *in bivouac*. Camps are also established to hold important military positions, and to invest or lay siege to a strongly defended work; *e.g.*, at Petersburg, Va., 1864–65. The choice of location, form, arrangement, etc., are greatly influenced by the object of its establishment; and in time of war, owing to liability of attack by surprise, these must conform to tactical requirements for rapidity of formation and movement.

Camp, INTRENCHED. Military position defended by field intrenchments, which are occupied by an army ready for battle. During the last year of the Rebellion both armies habitually intrenched their positions.

Campagna. Plain about Rome, long desolate and malarious, now partly redeemed by drainage.

Campaign. Series of military operations undertaken by an army for a specific strategical purpose; *e.g.*, Grant's overland campaign in 1864. Its object was the defeat of Lee's army and capture of Richmond. Operations began with crossing the Rapidan early in May, 1864, followed by the battles of the Wilderness, Spottsylvania, Cold Harbor, etc., and ended with the passage of the James R. at Fort Powhatan in June, 1864. It resulted in the investment of Lee's army and siege of Petersburg.

Campan, JEANNE LOUISE HENRIETTE, 1752–1822. French teacher, *Memoirs of Marie Antoinette*, 1823.

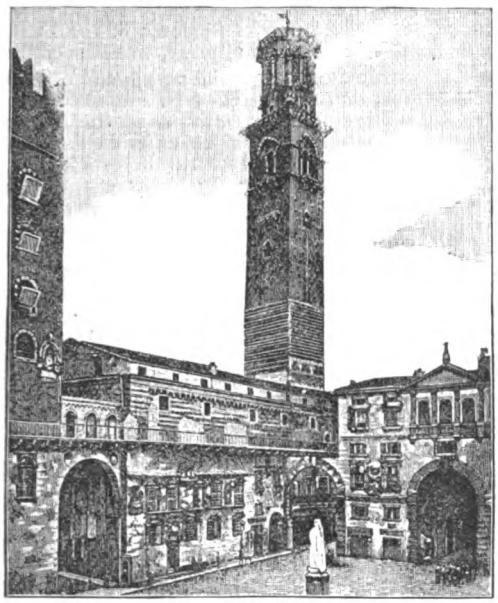
Campana Collection OF ANTIQUITIES. In the Louvre, Paris; especially rich in Greek vases and in Etruscan objects; purchased from the Vatican 1861.

Camp and Garrison Equipage. Articles issued by the quartermaster, relating to the domestic rather than the warlike purpose of the soldier, and carried by an army in the field or used in garrison, such as tents, fittings, camp utensils, shovels, axes, and clothing.

Campanella, TOMMASO, 1568–1639. Italian philosopher and poet, imprisoned at Naples 1599–1626, and seven times tortured. After some years at Rome, he went to France, 1634, to escape Spanish persecution. He was a Dominican monk, with opinions in some respects beyond his time. *Spanish Monarchy*, 1640; tr. 1658; *De Sensu Rerum*, 1620; *Civitas Solis*, 1623; *Atheismus Triumphatus*, 1631; *Philosophia Rationalis*, 1637; *Philosophia Universalis seu Metaphysica*, 1638.

Campania. Ancient province of w. Italy, s. of Latium; a favorite retreat of the Roman nobles in summer; originally inhabited by the Oscans, who were conquered by the Etruscans. The *Campani* of Roman times were a mixed race.

Campanile. Bell-tower, abundant in Italy and often notable, as those of Florence, Pisa, Venice and Verona. It is properly



Campanile, Palace of the Scaligeri, Verona.

restricted to the rectangular unbuttressed towers common in Italian architecture, whether flat at the top or surmounted with a steep roof.

Campanini, ITALO, b. 1846. Italian tenor, originally a blacksmith and Garibaldian soldier; first heard in England 1872 and in N.Y. 1873.

Campanulaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising 32 genera and ab. 550 species, widely distributed through all parts of the earth; commonly called the Campanula or Bell-flower family.

Campanulariæ. CALYPTOBLASTEA - LEPTOMEDUSÆ, THECAPHORA, VESICULATA. Sub-order of *Hydromedusæ*, in which the periderm widens out to form cups, into which the individual polyps can retract. The proliferating polyps have no tentacles nor mouth, and their thecæ often form closed gonangia, containing the gonophores, which bud out in regular series on the sides of the polyp. These buds are sometimes set free as medusæ, bearing the sexual cells on their radiating canals, and having on their margins both eyes and otocysts (hence the term *Vesiculata*). The families included are, *Plumularidæ*, *Sertularidæ*, *Campanularidæ*, *Aequoridæ*. The group is often considered under two sections, *Sertularida* and *Campanularida*, of which the corresponding families are typical.

Campanularidæ, or EUCOPIDÆ. Family of vesiculate *Hydromedusæ*, possessing cup-shaped hydrothecæ on the ends of ringed stalks. The generative buds of *Campanularia* become free medusæ that have four lips to the manubrium, four radial canals, four marginal tentacles, and eight interradial otocysts.

Campanulate. Bell-shaped corolla of many flowers, as those of the Harebell.

Campbell, ALEXANDER, 1788–1866. Irish-American divine, founder in 1811 of the DISCIPLES OF CHRIST (q.v.), often called "Campbellites," and in 1841 of Bethany College, W. Va.—His father, THOMAS, 1763–1854, was his associate.

Campbell, SIR ALEXANDER, 1822–1892. Canadian senator and minister, knighted 1879.

Campbell, SIR COLIN, 1792–1863. Scottish general, distinguished at the Alma and Balaklava, 1854. He commanded the army in India 1857; relieved Lucknow Nov. 22; defeated the Sepoys at Cawnpore Dec., was created Baron Clyde 1858, and field-marshal 1859.

Campbell, DOUGLAS, 1840–1893. American author. *The Puritan in Holland, England and America*, 1892.—His father, Judge WILLIAM W., 1806–1881, was M. C. 1845–47, and wrote *Annals of Tryon Co., N. Y.*, 1831.

Campbell, GEORGE, D.D., 1719–1796. Prof. at Aberdeen 1771–95. His *Dissertation on Miracles*, 1762, was in reply to Hume. *Philosophy of Rhetoric*, 1776.

Campbell, SIR GEORGE, 1824–1892. Anglo-Indian official and M.P. *Modern India*, 1852; *British Empire*, 1889.

Campbell, JAMES VALENTINE, LL.D., 1823–1890. Judge Supreme Court of Mich. from 1857. Law Prof. in Univ. Mich., 1859-84.

Campbell, JOHN LORD, 1779–1861. Atty. General 1834; Baron and Chancellor of Ireland 1841; Chief Justice of Queen's Bench 1850; Lord Chancellor 1859. His *Lives of the Lord Chancellors*, 7 v., 1846, and *Lives of the Chief Justices of England*, 3 v., 1849–57, were said to "add a new terror to death."

Campbell, JOHN ARCHIBALD, 1811–1889. Associate Justice of U. S. Supreme Ct. 1853–61; Asst. Sec. of War of Confederate States 1861.

Campbell, JOHN FRANCIS, 1822–1885. Scottish author. *Tales of the West Highlands*, 4 vols., 1860–62.

Campbell, JOHN MCLEOD, D.D., 1800–1872. Scottish theologian, deposed for heresy 1831. *Nature of the Atonement*, 1856; *Revelation*, 1862.

Campbell, LEWIS, LL.D., b. 1830. Prof. St. Andrew's, Scotland, 1863; ed. Sophocles and Plato.

Campbell, ROBERT, 1814–1868. Scottish translator of Latin hymns, 1850.

Campbell, THOMAS, 1777–1844. Scottish poet, author of *The Pleasures of Hope*, 1799; *Gertrude of Wyoming*, 1809, and

Thomas Campbell.

of several fine ballads, as *Hohenlinden*, *Ye Mariners of England*, and *The Battle of the Baltic*. He wrote in prose a *Life of Petrarch*, 1841, and edited *Specimens of the British Poets*, 1819.

Campbell's Act. 9 and 10 Vict. c. 93, 1846. Giving a right of action to the personal representatives of one whose death was caused by another's wrongful act, default or neglect, for the benefit of the decedent's wife, husband, parent or child. No such right existed at common law. Most of the U. S. have enacted similar statutes.

Campbell's Station. In Knox co., Tenn. Union forces under Burnside here repelled an attack by Confederates under Longstreet Nov. 16, 1863.

Campe, JOACHIM HEINRICH, 1746–1818. German publisher, lexicographer, and writer of juvenile tales and works on education.

Campeachy, GULF OF. S. part of Gulf of Mexico.

Camper, PIETER, 1722–1789. Dutch anatomist.

Camperdown. Locality in n. Holland, near which the English fleet under Admiral Duncan defeated the Dutch under Van Winter, Oct. 11, 1797.

Campestral. Plants which grow naturally in uncultivated fields.

Camp-Followers. Sutlers, traders and dealers, civilians, employés, servants and all who, though not soldiers, are, by their presence, amenable to the rules of military service.

Camp-Guard. Chain of sentinels, under the command of an officer, placed around a camp to guard it, to arrest suspicious persons, to allow no soldiers to pass without authority, and to warn the command of the approach of an armed body.

Camphene. Solid hydrocarbon, $C_{10}H_{16}$, a terpene of which there are two varieties, a dextro, and laevorotatory; produced by heating pinene monohydrochloride with alcoholic potash or dry soap.—Also a mixture of alcohol and turpentine, used as an illuminant from 1850–59.

Camphire. *Lawsonia alba.* Shrub of the natural family *Lythraceæ*, native of the Mediterranean region, producing a yellow dye. It is a white, translucent body, slowly volatilizing at ordinary temperatures, of an agreeable odor and bitter taste,

obtained by subliming the root, trunk and branches of the *Cinnamomum camphora* (*Camphora officinarum*) and *Dryanops camphora*, a tree of the natural family *Dipterocarpaceæ*. Is destructive of nearly all forms of insect life and used in medicine as an anodyne and mild irritant.

Camphor, ARTIFICIAL. $C_{10}H_{16}HCl$. Compound resembling camphor in appearance and odor, made by passing hydrochloric acid gas into oil of turpentine.

Camphor, COMMON, or JAPAN. $C_{10}H_{16}O$. Mpt. 175° C. Transparent prisms of characteristic odor, obtained from the camphor tree, *Laurus Camphora*, by distillation with steam. Yields cymene when heated with a dehydrating agent. In constitution an anhydride. Prepared artificially by oxidizing camphene.

Camphoric Acid. $C_8H_{14}(COOH)_2$. Mpt. 178° C. Produced by the oxidation of camphor by nitric acid; solid, dibasic acid, forming an anhydride when heated.

Campion. See CATCHFLY.

Campion, EDMUND, 1540–1581. English Jesuit of notable parts, tortured and executed under Elizabeth. *History of Ireland*, 1571; *Ten Reasons*, 1581.

Campion, MOSS. *Silene acaulis.* Alpine and arctic plant of the Pink family, native of the n. hemisphere.

Camp-Meetings. Held since 1790 in the U. S., chiefly by Methodists.

Campoamor y Campoosorio, RAMON DE, b.1817. Spanish poet and philosopher. *Doloras*, 1846; *Colon*, 1853; *Idealism*, 1883.

Campo-Formio, TREATY OF. Oct. 17, 1797, between France and Austria. It gave to France the Low Countries and the Ionian Islands, set up the Cisalpine Republic in n. Italy, and divided the Venetian dominions.

Campornanes, PEDRO RODRIGUEZ, COUNT, 1723-1802. Spanish statesman and writer on industry, education, and finance.

Campos, ARSENIO MARTINEZ DE, b. 1831. Spanish soldier, eminent in Cuba 1869–72 and against the Carlists 1873–76; minister of war 1879, 1881, and 1883–84; captain-general of Cuba 1876–78 and 1895.

Campo Santo. In Italy, a cemetery, especially when inclosed by cloisters. That of Pisa, the most famous, consists of an open court of oblong shape, surrounded by open arcades.

Wall Painting at Pisa, "Triumph of Death."

On the interior walls of these are many important wall paintings of 14th and 15th century art. The building also contains many rare relics, tombs, and ancient sarcophagi.

Camps of Instruction. Established to impart instruction in guard duty, drill and military maneuvers, and to inure new troops to the fatigues and duties of war; *e. g.*, the State Camp, at Peekskill, N. Y., for the N. Y. National Guard. Spring and autumn maneuvers in the field are now generally employed for the instruction of regular troops.

Campus Martius. Section of ancient Rome, originally devoted to military exercises; site of the modern city.

Campus Raudius. In n. Italy, scene of defeat of the Cimbri by Romans under Marius and Catulus, 101 B.C.

Campylite. Variety of mimetite, containing phosphorus as a replacement of arsenic.

Campylospermous. Seeds whose edges are inrolled so as to form a furrow.

Campylotropous. Ovule bent on itself so as to bring the foramen down close to the hilum.

Camwood. *Baphia nitida.* Tree of the Bean family, native of w. tropical Africa, producing a red wood which yields a dyestuff.

Cana. Town of Galilee, near Nazareth; where Christ turned water into wine (John ii.) and healed a nobleman's son (John ii., 46); birthplace of Nathaniel.

Canaan. Original name of PALESTINE (q. v.); peopled by Phoenician tribes, of a licentious and cruel worship. These, though subdued and partly exterminated by the Israelites, long remained a corrupting element.

Canachus. Greek sculptor of Sicyon, ab. 480 B.C. His colossal Apollo holding a deer, at Miletus, was especially famed.

Canada, DOMINION OF. Colonial possession of Great Britain, occupying most of the n. part of N. America. Its area is ab. 3,500,000 sq. m., including the islands of the Arctic Ocean. The great plateau of w. N. America extends n. w. across C. and into Alaska, but with less breadth and elevation than in the U. S. E. and n. from this mountain region stretches an area of plains sloping eastward to Hudson's Bay, a great arm of the Atlantic which occupies the lowest part of the continental depression.

The s. w. part of these plains resembles the great plain of the U. S. in its undulatory and treeless character; but n. of the Saskatchewan and e. of Lake Winnipeg it becomes lacustrine and forest-covered. Upon the shores of the Arctic Ocean and upon its islands are great areas of tundra. A second system of elevation, much less in area and in height than the w. one, is found in the e. provinces.

The river system is very extensive. In the s. e. part, the St. Lawrence, with the chain of Great Lakes, forms, by the aid of canals, uninterrupted navigation from the sea to the head of Lake Superior, a distance of full 1,700 m. From the Rocky Mts. and the plains flow numerous large streams, as the Saskatchewan and Churchill rivers, which find their way to Hudson's Bay, and further n. others, as the Athabasca and Peace, which unite to form the Mackenzie, one of the largest rivers of the continent, which flows to the Arctic Ocean. C. presents a great range of the elements of climate. The s. part is temperate, and in the s. e. there is a sufficient rainfall for the needs of agriculture. The same is true of the s. w. coast, but upon the s. plains the rainfall is often inadequate. On the w. coast the temperature is much higher than in the same latitude on the Atlantic coast. Except the s. w. part of the plains and the Arctic regions, C. is covered with forests, the cutting and manufacture of which forms an important industry. The trade in furs, particularly of the beaver, fox, otter, and marten, has long been profitable. The fisheries are extensive. Coal is mined in Nova Scotia and British Columbia, and petroleum and salt are obtained in Ontario. Agriculture is the leading industry, the cereals and fruit being the principal crops cultivated. The Dominion has a large commerce both upon the lakes and the sea, the average annual imports having a value of ab. $130,000,000 and the exports of ab. $100,000,000. Its railroads have a total length of over 14,000 m. The government is administered by a governor-general appointed by the crown, and by a legislature, the members of the upper house being also nominated by the crown, while those of the lower house are elected by the people. The capital is Ottawa, in Ontario. Other principal cities are Montreal and Quebec in Quebec, St. John in New Brunswick, Halifax in Nova Scotia, and Toronto in Ontario.

The first discovery of C., as also of the American continent, was by John and Sebastian Cabot in 1497; the first settlement by Europeans was made 1541 by JACQUES CARTIER (q.v.), who explored the coasts of Nova Scotia, New Brunswick, and Newfoundland, and sailed up the St. Lawrence. In 1608 a settlement was made by the French on the present site of Quebec; they continued to occupy the country under the name of New France until 1760, when it was ceded to England (see FRENCH AND INDIAN WARS). By the terms of this cession, equal civil and commercial privileges with the British subjects were granted to the French colonists, and a guarantee of freedom in the maintenance of the R. C. religion. This political transformation did not essentially change the character of the population; most of the people remained French in manners, language, and religion. At the American Revolution these provinces were loyal to England, and became an important base of operation against the States. In 1774 England had passed an act for the better government of C., providing for a legislative council to be appointed by the crown and for the extension into Canada of the principles and benefits of English law. In 1791 another policy was adopted, by which the province was divided into Upper and Lower Canada, and a popular Assembly provided for each province.

The only serious domestic disturbances have been the insurrection of 1837, which, though shortly suppressed, secured an extension of political rights by the practical subordination of the Upper to the Lower or popular Assembly, and Riel's Rebellion in the n. w., put down 1885. Since 1841 the government has been directly responsible to the people. In 1857 its seat was fixed at Ottawa, and in 1867, under the "British N. American Act," Ontario, Quebec, Nova Scotia, and New Brunswick united under the present name. In 1870 Manitoba, in 1871 British Columbia, in 1872 Prince Edward Island, and in 1882 Assiniboia, Saskatchewan, Alberta, and Athabasca were admitted. The opening, in 1886, of the Canadian Pacific Railway,

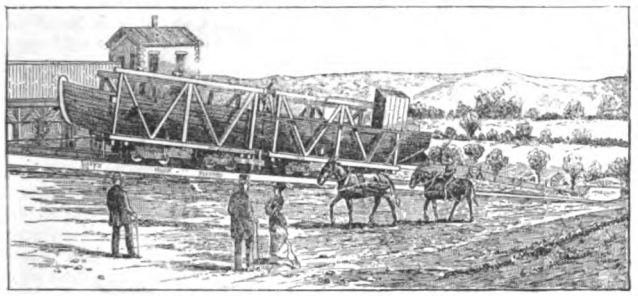
with a length of 2,906 m., has contributed greatly to the development of the w. provinces. Pop., 1891, 4,829,411.

Canadian River. Right hand branch of the Arkansas, heading in the Rocky Mts. in New Mexico and flowing through Texas and Indian Territory. Length ab. 900 m., drainage area 41,652 square m.

Canaletto, or **Canale,** ANTONIO, 1697–1768, and his nephew, BERNARDO BELLOTTO, 1720–1780. Italian painters, famed for views of Venice. Examples are in most European galleries and at Windsor Castle.

Canalis gynæcophorus. Groove on the ventral surface of the male distomum for receiving the female.

Canal Lift. Caisson into which a boat enters, and which is then lifted vertically by hydraulic power so that the boat can pass out into a higher level. One at Anderton, in England,



Canal Lift, Morris Canal, Bloomfield, N. J.

with a lift of 50 feet, has been in operation since 1876. Another method, frequently used for small boats, is to place the boat on a carriage and draw it up an inclined plane.

Canal Lock. Bay or chamber connecting the upper and lower levels on a canal; first used in Italy, 12th century. The lock being filled with water, a boat enters it from the upper level, and, when the water is discharged, falls to the lower level. The largest in the world is the new lock of the Sault St. Marie ship canal, connecting Lakes Superior and Michigan; it is 1,000 ft. long, 100 ft. wide, and 21 ft. deep.

Canals. The first built in Egypt and India to distribute water for irrigation. The Romans constructed several for navigation, one of which was in England. The Imperial canal of China, built in the seventh century, is one of the longest in the world, 825 m. Soon after, many were made in Holland. The Suez, Panama, Nicaraugua, Erie, Sault St. Marie, and other large canals are described under these headings. The James River and Kanawha Canal has the greatest lift, 1,916 ft. in a distance of 150 m. The Welland Canal in Canada, 27 m. long, connects Lakes Ontario and Erie, and has 25 locks with a depth of 14 ft. on sills. The cost of canals ranges from $50,000 to nearly $1.000,000 per m. The Erie cost nearly $230,000, the Suez ab. $800,000, per m. Inclined planes and hydraulic lifts are sometimes used insteads of locks. The Ellesmere Canal in England is carried over the Ceirog River by a stone aqueduct 710 ft. in length, which cost $233,000. Important canals are now under construction for the drainage of Chicago, and of the City of Mexico. Owing to the great development of railways, canals for navigation now constructed are mostly for the passage of vessels rather than boats. See SHIP CANALS.

Cananus, JOANNES. Greek historian who wrote on the siege of Constantinople in 1422.

Canary. Bird of Finch family, genus *Fringilla.* Native to region about Canary Islands. Color gravish brown and dusky green, but the numerous artificial breeds show varieties of yellow and black markings, crests, etc. Naturally monogamous, the male sings best to win the love of the female. She incubates the eggs, he feeds the young. Six eggs produced four times a year. Cross readily with allied species. Domesticated for nearly four centuries. See CONIROSTRES.

Canary Flower. *Tropeolum peregrinum.* Yellow-flowered vine of the Geranium family, native of Colombia; frequently cultivated.

Canary Grass. *Phalaris Canariensis.* Small grass, native of Europe and Africa, introduced in the U. S.

Canary Islands. Group in the Atlantic near n. w. Africa; supposed to be the "Fortunate Islands" of antiquity. Lost sight of for centuries, they were rediscovered 1334 by the French, and have belonged to Spain since 1493. Of the seven principal islands Teneriffe is the largest; its volcanic peak is 12,182 ft. high. The total area is 2,800 sq. m.; pop. 287,728.

Canary Wood. *Persea Indica* and *P. Canariensis.* Trees of the Laurel family, natives of the Canaries and Madeira.

Canby, EDWARD RICHARD SPRIGG, U.S.A., 1817–1873. General, murdered in Cal. by Modoc Indians.

Cancellation. Striking out factors common to dividend and divisor. It is proper whenever only the ratio of the quantities is to be considered.

Cancer. See ZODIAC.

Cancer. New formation, usually a tumor, caused by the multiplication of epithelial cells in the substance and lymphatics of any tissue which is ordinarily hard. Often softening in its later stages, not clearly separable from adjoining parts, with a strong tendency to ulcerate and to the formation of secondary growths in the vicinity, especially in glands, and as a rule returning after removal. Less properly any growth having the last named characteristic. Secondary growths are due to the dissemination by the lymphatics of the epithelial cells, which are not peculiar to cancer, but are those of the tissue in which it is found. Those of skin and mucous membranes are less liable to give rise to secondary growths, as their cells are of larger size and are less easily conveyed by the lymphatics. Transmission from one person to another is possible but barely probable. Inherited tendency exists in about one-third of the cases. Injured parts or those of low vitality, such as scars, warts, etc., or those subjected to constant irritation are often the seats of cancers but are not actively concerned in their development. From 60 to 70 per cent of cases occur among women, the breast being most often affected; in men the mouth and adjoining parts are oftenest attacked. Largest number of deaths among the living occurs in those of advanced years. Tobacco is said to be causative: but upon insufficient grounds, although the irritation caused by a pipe or cigar may furnish a vulnerable point in those predisposed to the disease. Death occurs, on the average, about four years after the first appearance of cancer and is due to the drain upon the system and to the involvement of parts necessary to life. Complete removal of diseased parts prolongs life about one year, and when the skin or mucous membranes are the parts affected may result in a perfect cure. Internal medication is entirely useless.

Cancer-Root. Species of the natural family *Orobanchaceæ.* parasitic on roots of various plants; especially applied to *Epiphegus Virginiana,* the Beach Drops, and *Conopholis Americana,* also called Squaw-root; natives of e. N. America.

Cancer, TROPIC OF. 23° 27′ n. lat.

Cancioneros. Collections of Spanish lyric poetry, religious or amorous, 1300–1600.

Cancrin, FRANZ LUDWIG VON, 1738–1812. German mineralogist and metallurgist, director of salt-works in Russia.

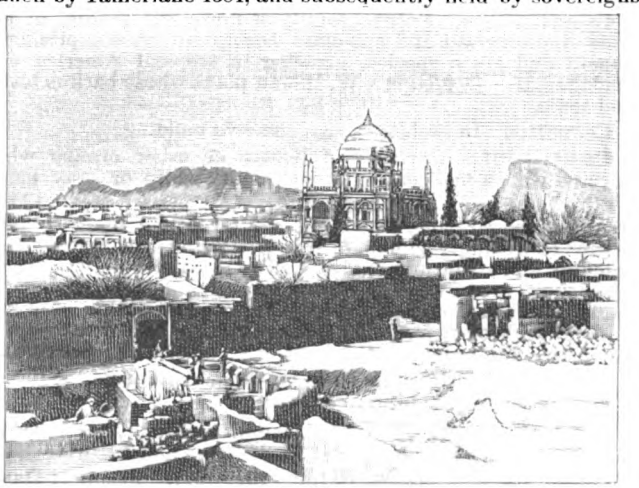
Cancrinite. Aluminum silicate of complex composition, containing several per cent of carbon dioxide.

Cancroidea. See CRABS.

Cancrum Oris. Disease of the mouth, most common in young children recovering from severe illness. It consists of a rapidly-spreading and destructive ulceration of the mouth, accompanied by great exhaustion of the vital powers, and is often fatal.

Candace. Name of each of an ancient line of Queens of Meroe, in Ethiopia, now Abyssinia. The treasurer of one of them, returning from Jerusalem, was converted to faith in Christ.

Candahar, or KANDAHAR. Capital of central Afghanistan; taken by Tamerlane 1384, and subsequently held by sovereigns



Candahar.

of Tartary, India, and Persia. Native rule was established 1747. It was occupied by the British 1839–42 and 1880. Pop. ab. 30,000.

Candelabra. Form of sponge spicule found in the genus *Platina.* It is a branched and spined desma.

Candelabrum. Commonly employed among the Greeks

and Romans to bear candles or lamps, and often of elaborate workmanship.

Candia. See CRETE.

Candleberry. See BAYBERRY and CANDLENUT.

Candle-Bombs. Pyrotechnic bombs, the shells of which are made of several thicknesses of stiff paper, containing a bursting charge; discharged from small mortars, and used for signaling or illumination.

Candle-Fish. See EULACHON.

Candlemas. Festival in R. C. Church, kept Feb. 2; originated 542, to commemorate the purification of the Virgin. It was instituted by Pope Sergius to take the place of the Roman holiday of the Goddess Februa.

Candlenut. *Aleurites triloba.* Tree of the natural family *Euphorbiaceæ*, native of s. e. Asia and Australasia. The fruit contains a valuable oil, used for illumination.

Candle-Power. Illuminating power of any source of light in terms of that emitted by a standard candle. The usual units for interior illumination vary from ab. 16 candle-power to 50 or more. The usual standard candle is made of spermaceti and burns ab. 2 grains per minute, to which rate it is corrected in making the calculation.

Candles. These are said to have been first used by early Christians in the caves and catacombs. In the 4th century Constantine illuminated Constantinople with lamps and candles. In the Middle Ages wax candles with tow-wicks were made which weighed 50 lbs. A candle consists of a cylinder of fat or wax upon a central wick. First came the Dips, with wicks of rush-pith, flax, or cotton, repeatedly immersed in wax, tallow, or household-grease. In the 15th century the Sieur de Brez introduced Mold candles, made by casting hard tallow, stearic acid, spermaceti, or paraffin, round a wick in a mold. Other forms are, Rolled, Poured, and Drawn; these methods are applied to wax because of the difficulty of molding it. Large church candles are made by rolling warm wax round a wick, or by pouring it over hanging wicks, which are afterward rolled under a board by hand. Drawn candles are made by drawing wick from one drum to another through a pan of wax, and then reversing it. On account of the cracking of the wax, only taper of small diameter is made in this way. Improved machinery enables the best Molds to be produced at lower cost than the commonest Dips. The wicks are of plaited cotton.

Candle Tree. *Parmentiera cerifera.* Tree of the Calabash family, native of Panama, bearing fruits resembling large candles.

Candlish, ROBERT SMITH, D.D., 1806–1872. Minister at Edinburgh from 1834; one of the founders of the Free Church, 1843. *Atonement*, 1845.

Candolle. See DE CANDOLLE.

Candor. That form of the duty of veracity which consists in freedom from reserve or disguise. It is rather a moral excellence than a duty.

Candytuft. Herbs of the genus *Iberis*, natural family *Cruciferæ*, natives of Europe, planted for ornament.

Cane. In the s. U. S., large shrubby grasses of the genus *Arundinaria.* Generally slender palms of the genus *Calamus*, natives of India.

Canellaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 3 genera and ab. 5 species, growing in tropical America and Madagascar. *C. alba* is a W. Indian plant whose bark is bitter and tonic.

Canelto. In architecture a concave molding.

Canescent. Surfaces of leaves or other organs when covered with a fine coating of very short white or gray hairs.

Cane Sugar, or SACCHAROSE. $C_{12}H_{22}O_{11}$. Mpt. 160°C. Found in sugar-cane, sorghum, red beet, and many plants; prisms exceedingly soluble in water, yielding saccharates with calcium and strontium oxides, $C_{12}H_{22}O_{11}+CaO+2H_2O$. These compounds are of value in working up the uncrystallizable molasses obtained from beets and cane. By the action of dilute mineral acids or of ferments it breaks down into dextrose and lævulose. If it be heated CARAMEL (q.v.) is formed. See SUGAR.

Cang. Wooden collar worn by Chinese convicts.

Canidæ. See CYNOIDEA.

Canina, LUIGI, 1795–1856. Italian architect, prof. Turin; author of works on the antiquities of Rome and Etruria.

Canisius, or **Hondt,** PETRUS, 1521–1597. Jesuit of Dutch birth, prof. at Ingolstadt 1549, provincial of the order for Germany 1556; active in Austria and Bavaria against the Reformation; beatified 1864. His two catechisms, 1554–66, in answer to Luther's, were widely circulated.

Canister Shot. See CASE-SHOT.

Canities. Decolorization of the hair.

Canitz. FRIEDRICH RUDOLPH LUDWIG, BARON VON, 1654–1699. German poet and statesman, ennobled 1698.

Canizares, JOSEPH DE, b. 1676. Spanish dramatist. Hi *Lucas*, a comedy, was highly esteemed.

Canker Worms. *Anisopteryx vernata*, *A. pometaria.* Spring and Fall cankerworm respectively according to time of laying eggs. Male is grayish moth, an inch across, wings banded; female is wingless, a third inch long, resembles a spider; crawls up fruit and elm trees, lays eggs on twigs. Larvæ are brownish "measuring worms" an inch long. Smear tree trunks with tar or oily ink, or spray with arsenites to destroy them.

Canna. Genus of large-leaved, red or yellow flowered endogens of the natural family *Marantaceæ*, natives of tropical America, much planted for ornament.

Canna indica.

Cannabis. Genus of plants containing only one species, *C. sativa*, HEMP (q.v.).

Cannabis Indica, or SATIVA. Species of urticaceous plants, the pistillate ones of which furnish flowering tops and a resinous exudation smoked extensively in the East, either alone or mixed with tobacco on account of its producing an agreeable form of intoxication and used in medicine to induce sleep and relieve pain. The tops and resin are known as BANG and HASHISH (q.v.).

Cannæ. Village in a plain of Apulia, s. Italy; where the Romans were defeated by Hannibal 216 B.C.

Cannel Coal, or PARROT COAL. Variety of bituminous coal, containing a large percentage of volatile matter, and therefore easily kindled and valuable as a source of gas. Boghead cannel has 66.35 volatile matter, 30.88 fixed carbon and 2.77 ash. It is of dark color, dull luster, and compact grain, without distinct lamination. The peculiar texture is supposed to be a result of a pulpy or clayey condition of the vegetable matter from which the coal was formed. The British cannel enjoys the highest reputation. In the U. S. found in W. Va., Ky., and a few other States.

Cannibals. Eaters of human flesh; numerous from earliest times among savage tribes, and still found in parts of Oceanica, Africa, Asia, and S. America. The victims are usually prisoners of war, sometimes criminals. The custom often had a religious origin.

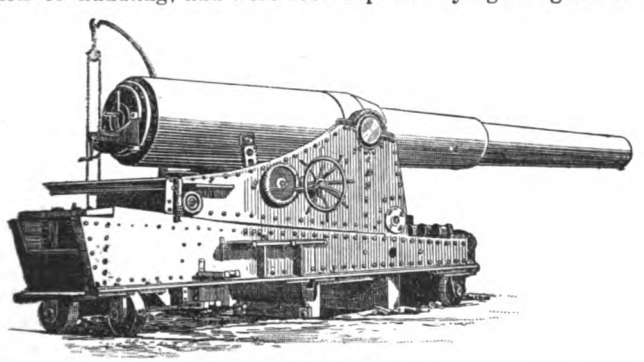
Canning, GEORGE, 1770–1827. M. P. from 1794; minister in several cabinets; eminent as an orator, and long active in British politics; author of the *Needy Knife Grinder*, and other pieces in the *Anti-Jacobin*, 1797–8.—His third son, CHARLES JOHN, 1812–1862, became Viscount C. 1837 and earl 1858; gov.-gen. of India 1856–62, viceroy 1858, after the Sepoy mutiny.

Canning, SIR SAMUEL, b. 1823. Engineer, knighted 1866. He laid the Atlantic and other submarine cables.

Canning, STRATFORD. See STRATFORD DE REDCLIFFE.

Cannon. All projectile weapons, except portable arms, designed to fire heavy missiles by means of gunpowder or other explosive compounds. They are classified, in reference to their service, into mountain, field, siege, seacoast, and marine guns, and, as regards high or low angle fire, into guns, howitzers, and mortars; into smooth bores and rifles, and muzzle and breech loaders. Cannon were first cone-shaped like an apothecary's mortar, and called mortars, vases, or bombards; afterward, being gradually lengthened, their bores made cylindrical and their powder chambers relatively long, they were called perriéres because of their stone projectiles. The use of cast-iron projectiles led to guns of greater length, called culverins. The mortar, for high angle shell fire, is due to the French in 1634; the howitzer, a short gun for low angle shell fire, was named after the Dutch artillerist, General Haubitz, its inventor; the carronade, a short gun or navy howitzer, was invented by Gascoigne and named from the Carron Iron Works, Scotland, where it was first made 1799. Cannon were probably first used at the siege of Cambray 1339, or of Quesnoy 1340; certainly by Edward III. in 1347 at Calais. At first they were made of iron bars bound with hoops, then of wrought iron, then cast in bronze (at Augsburg 1378), and finally, as the art of casting developed, almost wholly made of cast iron. Cast-iron guns were made in England 1550, and this method continued for 300 years, till the Crimean war. From 1854 to 1880 cast-iron guns were strengthened by wrought-iron bands shrunk on near the seat of the charge; since 1880 built-up steel guns have been universally adopted for all artillery armaments. Wire-wound steel guns have been recently devised, and are now at their experimental stage.

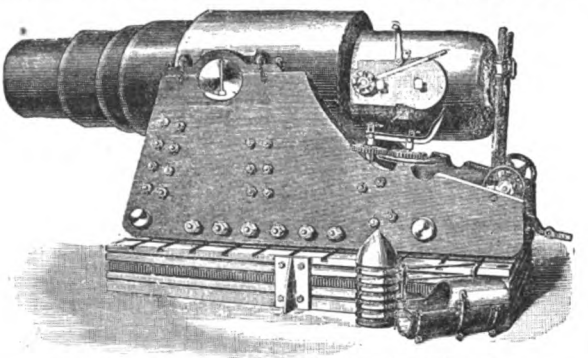
Of the early wrought-iron guns, the most noted are the Dulle-Griete of Ghent 1430, caliber 25 in., projectile, stone, 700 lbs., and the Mons Meg of Edinburgh 1455, caliber 20 in., projectile, stone, 400 lbs. Of the early bronze guns, that of Mahomet II., used at the siege of Constantinople 1463, caliber 25 in., granite projectile 672 lbs., and that of Moscow 1586, caliber 36 in., wt. 86,240 lbs., stone projectile 2,000 lbs., are the most remarkable. These early guns, designed to fire very heavy masses of stone or iron, were too cumbersome for transportation or handling, and were soon replaced by lighter guns not



Breech Loading Gun, U. S. Model 1888, 10 in.

exceeding calibers of 32 and 42 pounders. Up to 1820, the heaviest gun used in the U. S. seacoast service was the 24 lbs. The columbiad, invented by Colonel Bomford 1812–14, a smooth-bore chambered gun to fire shot and shell, lasted till 1848–50, when Rodman introduced new methods of casting and made such improvements in gunpowder that his 8, 10, and 15 in. columbiads entirely superseded all others. Dahlgren's investigations in regard to the best exterior form of guns resulted in the efficient 9 and 11 in. Dahlgrens for the navy; in 1863 Rodman cast a 20 in. smooth bore, of which two only were completed; this gun weighed 58.5 tons and its projectile 1,080 lbs.; it marked the limit of development in smooth-bore guns. Improvements in rifled ordnance from the time of the Crimean war have been steadily progressive, passing from the muzzle-loading cast-iron banded gun to the built-up steel breech-loading gun of to-day. Many of these cast-iron muzzle-loading rifles were formidable instruments in their day and did good service, as the 100 lb., 200 lb., and 300 lb. Parrott rifles during the Rebellion. England held to the muzzle-loading system till 1880, long after other nations had abandoned it.

The modern high-powered gun consists of a steel tube containing the chamber and rifled bore; the jacket which supports the breech block; and the hoops, of which there are two chase, three reinforce, and one trunnion hoop. These parts are carefully dimensioned, so that the outer hoop shall have less interior diameter than the part on which it is to be shrunk; when cooled it will bring a compressive strain on its inner neighbor. The whole gun when fired is designed to withstand the enormous stresses of the high explosives of which the charge consists. There are several systems of closing the breech, of which the two most used are the French and the Krupp; obturation is provided for by the use of the De Bange Pad, the Elswick Cup, or the Broadwell Ring, of which the first has been adopted in the U. S. service. The parts of the army guns, when received from the private firm to whom the contract is given, are assembled and finished at the U. S. gun factory at Watervliet, West Troy, N. Y.; for the navy guns this is done at the Washington Navy Yard. The details of the armament for the military and naval services are given in the accompanying tables. Completed guns have been furnished to U. S. Government by the Bethlehem Iron Co.



Krupp's 1000-Pounder Gun at the Paris Exhibition, 1889.

Breech-loading Ordnance, U. S. Land Service.

	Hotchkiss mountain gun, steel.	Field artillery, steel.			Siege artillery, steel.		
		Light gun, model 1890.	Heavy gun, model 1891.	Mortar, model 1890.	Gun, model 1890.	Howitzer, model 1890.	Mortar, model 1892.
Caliber ....inches..	3	3.2	3.6	3.6	5	7	7
Weight:							
Pounds	218	805	1,181	244	3,660	3,710	1,715
Total length ....feet..	3.76	7.31	7.79	2.05	12.15	8.475	4.86
Powder charge:							
Kind	(a)	(b)	(b)	(b)	(c)	(a)	(c)
Weight . ....pounds..	0.875	3.5	4.1875	15 oz.	12.5	10	5.5
Projectile:							
Weight .....pounds..	12	13.5	20	20	45	105	125
Pressure in powder chamber, pounds per square inch	14,560	35,000	35,000	16,000	35,840	28,224	18,000
Muzzle velocity...feet-second..	870	1,685	1,550	650	1,830	1,085	690
Muzzle energy.....foot-tons..	63	266	333	59	1,045	857	412
Penetration of steel:							
Muzzle .....inches..	1.4	3.8	3.9	1.1	6.2	3.8	2.2
3,500 yards .....inches..	.....	.....	.....	.....	2.5	2.4	.....

a I. K. granular. *b* U. F. sphero-hexagonal. *c* I. B. sphero-hexagonal.

Breech-loading Ordnance, U. S. Land Service.

	Seacoast guns, steel.					Seacoast mortars.	
	Model 1888, M.	Model 1888, M.	Model 1888, M.	Model 1892.	Proposed.	Cast iron, steel-hooped.	Steel.
Caliber .....inches..	8	10	12	12	16	12	12
Weight:							
Pounds	32,372 / 32,480	67,200	116,480	128,719	280,000	31,920	29,120
Total length .....feet..	23.21	30.60	36.66	40.0	49.67	10.75	11.76
Powder charge:							
Kind	(a)	(b)	(c)	(d)	(d)	(e)	(e)
Weight ..... pounds..	125	250	450	487	1,060	80	105
Density of loading ...	0.9619	0.9797	1.0285	1.0535	1	1.1128	1.1026
Projectile:							
Weight .....pounds.	300	575	1,000	1,000	2,370	8,000 / 1,000	800 / 1,000
Pressure in powder chamber, pounds per square inch	37,000	37,000	37,000	38,000	37,000	27,500	30,000
Muzzle velocity ..... feet-second..	1,950	1,975	1,975	2,100	1,975	1,020	1,140
Muzzle energy.. foot-tons	7,907	15,548	27,040	30,570	64,084	5,770	7,207
Penetration in steel:							
Muzzle..... .. inches..	16.0	20.4	24.9	27.1	33.8	8.2	9.7
3,500 yards....inches..	10.6	14.6	18.7	20.6	27.5	.....	.....

a U. R. brown prismatic.
b W. H. brown prismatic.
c V. P. brown prismatic.
d Brown prismatic.
e V. M. brown prismatic.

Breech-loading Ordnance, U. S. Naval Service.

	Main battery guns, steel.								
	Rapid fire.	Rapid fire.	Mark III, 50 calibers.	Mark III, 40 calibers.	Mark III, 35 calibers.	Mark III, 40 calibers.	Mark II, 35 calibers.	Mark I.	Mark I.
Caliber.....inches..	4	5	6	6	8	8	10	12	13
Weight: Pounds.....	3,400	7,000	10,800	13,370	29,400	34,000	61,900	101,300	135,500
Total length ...feet..	13.7	17.4	16.3	21.3	25.4	28.7	31.2	36.8	40.0
Weight of powder charge (brown)... pounds..	14	30	47	47	115	115	240	425	550
Projectile: Weight .....do..	33	50	100	100	250	250	500	850	1,100
Pressure in powder chamber ...tons per sq. in..	15	15	15	15	15	15	15	15	15
Muzzle velocity, feet-second	2,000	2,250	2,000	2,150	2,080	2,150	2,100	2,100	2,100
Remaining velocity 2,500 yards .....feet-second..	1,246	1,374	1,402	1,507	1,615	1,670	1,724	1,777	1,805
Muzzle energy...foot-tons..	915	1,754	2,973	3,204	7,498	8,011	15,285	25,985	33,627
Penetration in steel at muzzle .....inches..	7.18	9.0	10.27	11.38	15.61	16.10	20.10	24.16	26.66

Cannonade. Artillery attack, usually delivered against a fortified place just previous to an intended assault by infantry.

Cannon-Ball. Projectile fired from a cannon; formerly made of granite, then of cast or wrought iron, and finally, for heaviest projectiles, of steel. See PROJECTILES.

Cannon-Ball Tree. *Couroupita Guianensis.* A large tree of the Myrtle family, native of Guiana, its fruit a large, woody pericarp, six inches or more in diameter.

Cannon-Bone. See METAPODIALS and ARTIODACTYLA.

Cannon-Shot. Range of a projectile fired from a cannon. It has increased from a few hundred ft. to over 12 m.

Cannostomæ. Sub-order of *Discomedusæ*, having a four-cornered prism-like manubrium, but no arms around the mouth, which is single and simple; there are short solid tenacles. E.g., *Linerges*, the "Thimble-fish" of Florida beaches.

Cannotidæ. Family of *Leptomedusæ* without ear-cysts (otocysts), but having marginal eyes (ocelli) and compound radial-canals.

Cannstatt. Town of Würtemberg, near which a battle was fought 1796 between Gen. Moreau and the Archduke Charles. Pop. 1890, 20,267.

Cannula. Tube, generally with a sharp point or containing a cutting instrument, used for withdrawing morbid collections of fluid from the body.

Cano, ALONSO, 1601–1667. Spanish painter, architect and sculptor. Though only seen outside of Spain, his work ranks next to that of Velasquez and Murillo.

Cano, JUAN SEBASTIAN DEL, ab. 1460–1526. Spanish navigator, Magellan's successor in command; first to circumnavigate the globe, 1521–2.

Canoe. Boat usually formed of a tree-trunk hollowed out by cutting or burning, and propelled by paddles held perpendicularly instead of oars horizontally. It is found among natives of both hemispheres and all zones. The Laps and Esquimaux sew skins over bone framework and form half-decked canoes. In N. America strips of birch-bark are sewn together to make the most perfect river transport known. Fiji war-canoes are of enormous size and very ornate.

Canoeing. This sport has now reached a stage in its development where a certain class have made it a special sport. This has come about only during the last thirty years. In the 'Sixties English canoeists, with Macgregor at their head, were being numbered by hundreds, and in 1874 the sport began its progress in America. The American Canoe Association was formed at Lake George in 1880. In the first year thirty canoes were present, in the second year sixty, and in the third year one hundred and thirty. From that time associations were formed, and each grew independently. Canadian associations have attracted many, and at the present day there are in the U. S. and Canada hundreds of clubs and thousands of members. Meets and races are frequent, and the types have steadily improved along the lines of, and developing from, the old *Rob Roy* and *Shadow*.

Canon. Name given in w. U. S. to a precipitous valley, or rocky gorge, cut deep by a water-course. The Colorado Canon is the most famous example.

Canon. Musical composition for two or more parts, in which the melody is imitated strictly by all the voices entering at different times on the same or a different pitch; *e.g.*, the familiar round, "Three blind mice."

Canonical Form. Simplest form to which a quantic can be reduced without loss of generality.

Canonical Hours. Times set apart for special daily devotions; originally at 9, 12, and 3. Others were afterward added, under varying names.

Canonicus, d. 1647. Sachem of the Narragansett Indians; friend of the Pilgrims and of Roger Williams.

Canonization. Act of enrollment among the saints; once exercised by bishops or synods; claimed by the Pope 1170, and made exclusively his 1634.

Canon Law. That of the Eastern Church was codified 883 (see Beveridge's *Pandectæ*, 1672–82); that of the Western Church was systematized between 1150 and 1600 (see Freidberg & Richter's *Corpus Juris Canonici*, 1879). It is the common law of both the Catholic and the Protestant Churches of Germany; it is the basis of the law of the Ch. of England, and is one of the sources of the common law of England, and of that of Scotland. See *Elements of Canon Law*, Reichel, 1889.

Canon of Scripture. Collection of books received as divinely inspired. Protestants reject O. T. Apocrypha; otherwise there is general agreement.

Canons, CATHEDRAL. Members of a cathedral chapter; originally, and still in some places, electors of the bishop. Churches having canons without a bishop are usually called Collegiate.

Canons, ECCLESIASTICAL. Decisions and ordinances of the older churches, respecting either doctrine or discipline, especially the latter.

Canopus, or CANOBUS. Ancient Egyptian city at the Canopic mouth of the Nile. Ancient geographers considered it the boundary between Asia and Africa. Hence named are also the Canopic vases in which the viscera of the mummy were interred. These are always four; their covers represent the heads of the four genii or guardians of Amenti, the spirit world.

Canopy. In architecture the covering of a niche, or the decorative structure erected over a shrine, tomb or other object of devotion; also applied to the traceried gable over a doorway.

Canossa. Castle in n. Italy where the emperor Henry IV. submitted to Pope Gregory VII., Jan. 1077, standing three days

Canossa.

at the gates with bare head and feet before he could gain admission.

Canova, ANTONIO, 1757–1822. Italian sculptor, leader of the Greek Revival style in statuary, which followed the discov-

eries and influence of John Winckelmann. As contrasted with the minute realism, affectation, and extravagance of earlier 18th century art, his style was modeled on the antique, although without reaching its greatness. In subjects demanding vigorous treatment he was apt to fall into the errors of his predecessors in the matter of theatrical tendencies. His treatment of surface imitates the cold and formal execution of the Roman copyists of Greek art rather than the vigorous life of the original Greek sculpture, which was not known to the critics of his day. C. was at his best in subjects requiring tenderness and delicacy of thought and execution. With all his limitations he remains the greatest sculptor of the generation which preceded Thorwaldsen. His works at Rome include the

Antonio Canova.

tomb of Pope Clement XIII. in St. Peter's, the statues of the *Boxer* and of *Perseus* in the Vatican, and the *Venus* of the Borghese Villa. In Florence is the tomb of Alfieri (Ch. of Santa Croce) and the *Venus* of the Pitti Gallery. In Venice is the tomb of Titian (Santa Maria dei Frari) and in Vienna the tomb of the Archduchess Christina (Ch. of the Augustinians). There are several replicas of the *Cupid and Psyche* of the Louvre.

Canvas. Coarsely-woven hempen or linen cloth, generally unbleached, used for tents, sails, and oil-paintings. The coarsest kind is also used for embroidering, tapestry, and other ornamental needlework.

Canovas del Castillo, ANTONIO, b. 1828. Spanish monarchist, premier 1874–76, 1877–85, 1890–92, and 1895; author of *Philip IV.*, 1888, and other works.

Canrobert, FRANCOIS CERTAIN, 1809–1895. French general of division 1853; wounded at Alma; commander-in-chief 1854–5; marshal 1856; prominent at Magenta, Solferino, and Metz; senator 1876.

Cantabri. Ancient mountaineers of n.w. Spain, supposed to have been of Iberian stock; subjugated by the Romans 25–19 B.C. The Basques may be their descendants.

Cantabrian Mountains. Range in n. Spain, continuing the Pyrenees w. They rise to heights of 10,000 ft.

Cantacuzenus, JOHN, d. 1383. Byzantine emperor 1341–55.—His son, MATTHIAS, was his colleague from 1353.

Cantata. Choral composition, of smaller dimensions than an oratorio, and generally on a secular subject. Originally it was a dramatic story told in recitation with instrumental accompaniment; afterward the recitation was interspersed with airs, grew into the concert aria, and then into its present form.

Canted. In architecture denotes square angles cut off diagonally, as in a canted oriel window.

Canteen. Tin vessel, carried by the soldier to hold water on the march. Post canteens are stores authorized by army regulations, at military posts where there are no post-traders; their object is to supply the troops at moderate prices with articles necessary for their use, also to afford the requisite facilities for gymnastic exercises and proper games.

Cantemir, DEMETRIUS, 1673–1723. Moldavian dignitary, educated in Constantinople, and resident in Russia from 1711. *Hist. Ottoman Empire*, tr. 1734.

Canterbury. City in East Kent, on the R. Stour, 56 m. e. s. e. from London; seat of the Primate of all England. The cathedral was built ab. 740, burned 1067, rebuilt 1070–1130. It

Canterbury Cathedral.

is 545 ft. long, with a central tower 235 ft. high. Thomas à Becket was murdered here in the north transept 1170. Pop., 1891, 23,026.

Canterbury Tales. Chaucer's greatest work; written separately and then arranged in a series after his plans in the prologue 1388. Two of them are in prose. The finest are *The Knighte's Tale*, *The Man of Lawes*, and *The Clerk's*. The series exhibits Chaucer's range of poetic power and his matchless gift of story-telling in verse.

Cantharides. Spanish flies, or dried specimens of *Cantharis Vesicatoria*, used in medicine to blister, and popularly supposed to arouse the sexual appetite when taken internally. This is not the case unless the dose is sufficiently large to excite severe and often fatal irritation of the kidneys and bladder.

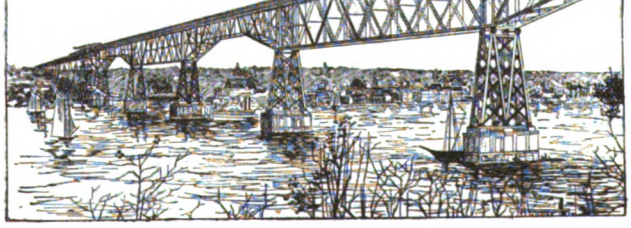
Cantharis. See HETEROMERA.

Canthus. Corner of the eye.

Canticles. See SONG OF SOLOMON.

Cantilever. Beam or truss fastened at one end and having its other end without support, as in a movable drawbridge. The projecting ends of the beams supporting the sidewalks of a bridge are cantilevers.

Cantilever Bridge. Bridge having two anchorages and two towers, the portion between the towers consisting of two cantilever arms which support a central span. Thus loads placed upon either cantilever arm have no effect upon the central span. The first was that built 1883 over the Niagara river, one mile below the falls; it is 910 ft. long. The longest is the Forth bridge in Scotland, with two spans of 1,700 ft. each. The longest in the U. S. is that over the Mississippi at Memphis, having a channel span of 790½ ft. and a total length of 2,258 ft. A design has been made for one over the Hudson at



Cantilever Bridge.

New York, with a central span of 2,100 ft. The great advantage of the cantilever system is in ease of erection, false works being unnecessary for the central span. It is, however, probably not as well adapted to the longest spans as the suspension system. The picture shows the bridge over the Hudson at Poughkeepsie, with spans of 525 ft.

Canto fermo, or CANTUS FIRMUS. Plain melody which

composers make the basis of their contrapuntal compositions. See COUNTERPOINT.

Canton. Commercial city of China, on n. bank of Pearl R., ab. 70 m. from the sea. It was visited by the Arabs in the 9th century, by the Portuguese 1517, then by the Dutch and English, and opened to foreign trade 1700; held by French and English forces Dec. 1857 to Oct. 1861. Till 1842 it was the only treaty port. It has famous pagodas, 124 temples, and an examination hall with 8,653 separate cells. Pop., ab. 1,600,000.

Canton. Capital of Stark co., Ohio. It has large manufactories of agricultural implements. Pop., 1890, 26,189.

Cantonment. Lodgment of an army temporarily withdrawn from active operations, scattered over a considerable area, sheltered at farms, villages, etc., thus more easily subsisted, yet readily available for concentration at need.

Cantu, CESARE, 1804–1895. Italian historian and patriot. *Universal History*, 35 v., 1834–42; *Hist. Italiano*, 1854; *Last 100 Years*, 1864; *Italian Heretics*, 1866; *Manzoni*, 1883. His romance, *Margherita Pusterla*, 1838, was written "with a toothpick and candle-smoke" in prison.

Canula. Hollow cylindrical instrument used in surgery.

Canute, or CNUT, d. 1035. King of England, at first (1015) by succession to the conquests of his father Sweyn, then by his own and by partition with Edmund; reigning alone from 1017: king of Denmark 1018, and of Norway 1030. His rule was in the main wise and just.

Canvas-Back. *Aythya Vallisneria.* Species of Duck found in n. N. America. Migrates south in fall, and feeds on wild celery. Its flesh is much esteemed as food. So called on account of the appearance of its back.

Canvas Pontoon. Light pontoon boat used with cavalry in raiding operations. It consists of two boat-frames or side rails, and transoms or connecting pieces, over which a strong duck canvas is stretched. The water swells the cotton thread of the canvas, and thus prevents leaking even under heavy pressure.

Canzone. Variety of Italian lyric poetry.

Caoutchouc. RUBBER. $(C_{10}H_{16})x$. Hydrocarbon. Elastic gummy substance occurring in the milky juices of various plants of the natural families *Urticaceæ*, *Euphorbiaceæ*, and *Apocynaceæ*, and in smaller amount in others, yielding the india rubber of commerce by evaporation. It is a white amorphous substance, which absorbs oxygen from the air and readily combines with sulphur to form a species of sulphide which constitutes the vulcanized rubber of commerce. For ordinary soft rubber 16 parts rubber are mixed with 1 of sulphur, 2 litharge, 1 whiting and 2 white lead, and heated to 225° F. for 5 hours. For hard rubber or vulcanite, 16 parts rubber are mixed with 8 sulphur, and heated to 300° F. for 3 hours.

Cap. (1) In mining, horizontal piece at top of a set of gangway timbers. (2) Halo appearing about the flame of a safety-lamp in presence of fire-damp.

Capacity. Ability to acquire legal rights, to obtain legal redress, or to incur legal liability. Its absence may be natural, as when the person has not the ability to understand the quality and effect of his act; or artificial, as when it is imposed by arbitrary law. In the law of contracts, the incapacity of a party plays an important part; in torts, it is generally immaterial.

Capacity (ELECTRIC). The capacity of a conductor or condenser is equal to the quantity of electricity necessary to raise its potential by unity. If C denote capacity, Q charge, and V increase of potential, $C=\frac{Q}{V}$. As the potential at the surface of a charged conducting sphere is equal to $\frac{Q}{R}$, evidently the capacity of such a sphere is equal to its radius. The capacity of a condenser is proportional to the specific inductive capacity of the dielectric employed, and also to the surface of the conductor. In a Leyden jar $C=\frac{KS}{4\pi t}$, where t is the thickness of the glass. (See FARAD.) The capacity of a storage battery is the number of ampere-hours of current energy it will furnish.—(THERMAL.) The capacity of a body for heat is equal to the number of heat units necessary to raise its temperature 1° C.

Cape Barren Goose. *Cereopsis novæ-hollandiæ.* A peculiar native goose of Australia, with deep bill, large, greenish-yellow cere, red eyes, orange legs, ashy brown plumage. Lives always on land. Flesh fine-flavored. In wild state practically exterminated, but has been domesticated. It is remarkably pugnacious.

Cape Breton. Island n. e. of Nova Scotia, to which it was attached 1819; taken from France 1745 and 1758. (See LOUISBURG.) Area 5,365 sq. m.; pop. ab. 90,000.

Cape Canaveral. On e. coast of Florida.

Cape Cod. Peninsula forming e. part of Mass.

Cape Cod Bay. Indentation on e. coast of Mass., between the cape and the mainland.

Cape Colony. British possession at s. end of Africa. The surface consists of a series of mountain-ranges, trending nearly e. and w., with broad valleys alternating between them, and rising northward. The principal river is the Orange, which forms part of the n. boundary. The chief industries are agriculture and the raising of live stock; there is a large commerce. Cape Town is the capital. It was first colonized by the Dutch 1652; conquered 1806, and formally transferred to England 1815. A colonial parliament was created 1853, and in 1872 "responsible government" was conceded. Diamonds were discovered on the Vaal R. 1867; in 1870 there were 10,000 diggers; the output to 1888 amounted to nearly $80,000,000. The extent of the colony has been increased three times by annexation 1866–80, and now comprises 221,311 sq. m. Pop., 1891, 1,527,224, of whom three-fourths are native Africans.

Cape Fear River. In central and e. N. C., with mouth near Cape Fear. Drainage area 8,310 sq. m., length 192 m.

Capefigue, BAPTISTE HONORE RAYMOND, 1802–1872. French journalist and politician, author of nearly 100 vols. of history. *Philip Augustus*, 1829; *The Restoration*, 1842.

Cape Finisterre. N. w. extremity of Spain. A French fleet under De la Jonquierre was defeated here by the English under Anson and Warren, May 3, 1747.

Cape Hatteras. E. of Pamlico Sound, N. C.

Cape Henlopen. In Del., opposite Cape May, at entrance of Delaware Bay.

Cape Horn. S. extremity of S. America, dangerous to seamen.

Capella — α AURIGAL. First magnitude star. Right ascension — 5h. 8m. 29s.; declination — 45° 53′ 3″ North. The parallax as determined by Peters 1846 is 0″.046; by Otto Struve 1856 is 0″.305. If we adopt the first value, the light from the star requires 70.9 years to reach the earth; if the second be correct, the time is 10.7 years.

Capella, MARTIANUS MINEUS FELIX, ab. 450–500. Latin author of Carthage. His work is in nine books of prose and verse. The first two, *Nuptials of Philology* and *Mercury*, are allegorical and introductory, the others set forth the seven liberal arts: *i.e.*, Grammar; Dialectics, including Metaphysics and Logic; Rhetoric; Geometry, with Geography; Arithmetic; Astronomy; Music, with Poetry. It contained a vast, ill-digested collection of learning, and was esteemed a complete encyclopedia of knowledge during the Middle Ages.

Cape May. S. end of N. J.; summer resort.

Cape of Good Hope. Near s. extremity of Africa, discovered by Portuguese 1487, named by John II., who hoped for an eastern passage.

Capernaum. City of Galilee, on n.w. coast of Sea of Tiberius; frequently mentioned in Gospels, but not in O. T.

Capers. Flower buds of *Capparis spinosa*, a prickly-branched shrub of the family *Capparidaceæ*, native of desert regions near the Mediterranean. The buds when pickled in vinegar form the commercial article.

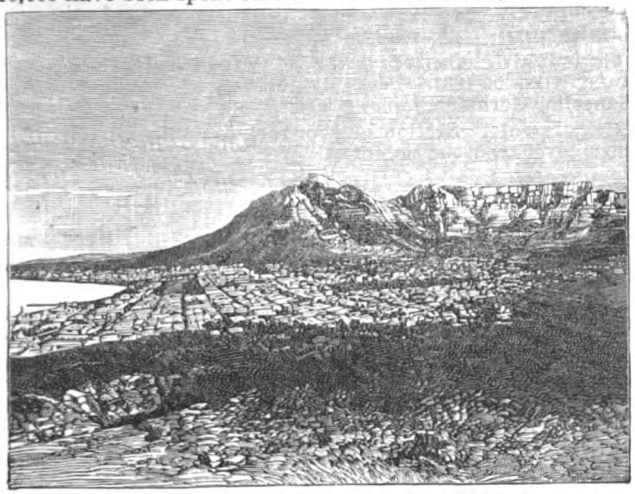
Caper Spurge. *Euphorbia Lathyris.* Coarse herb of the Spurge family, native of Europe, introduced into N. America. Its fruit is sometimes used as a substitute for capers, but with danger, as it is poisonous.

Cape St. Vincent. S. w. extremity of Portugal. Near this point the English and Dutch lost 12 men-of-war and 80 merchantmen to the French under Tourville, June 16, 1693, and a Spanish fleet was defeated, Feb. 14, 1797, by the English under Sir John Jervis, for which he was made Earl St. Vincent.

Capetian Dynasty. Third race of French monarchs named from Hugh Capet, 940–996, made king 987. The older Capets reigned 987–1328; the Valois 1328–1589; the Bourbons 1589–1830; the Orleans 1830–48.

Cape Town. Capital of CAPE COLONY (q.v.), founded 1652, on Table Bay, near the s. w. extremity of Africa. Over $11,-

000,000 have been spent on the harbor and docks, which afford



Cape Town.

a stopping-place for many vessels; the annual shipping is some 400,000 tons. Pop., 1891, including suburbs, 83,718.

Cape Verde. W. point of Africa; lat. 14° 50′ n.

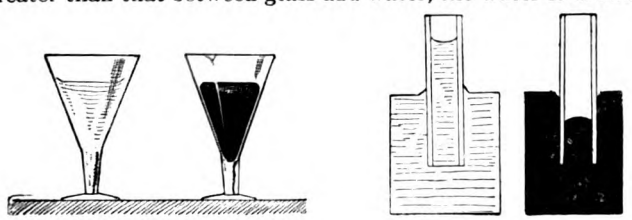
Cape Verde Islands. Group in e. Atlantic, 320 m. w. of Cape Verde, belonging to Portugal. Area ab. 1,600 sq. m.; pop. ab. 115,000.

Capias. Common law writ for the seizure of a person by an officer. *C. audiendum*, take him to hear judgment; *C. ad respondendum*, to answer a complaint; *C. ad satisfaciendum*, to satisfy a judgment; *C. utlagatum*, take an outlaw; *C. in ovithernam*, to take in reprisal goods equal to those taken by a distrainer and concealed.

Capillaries. Minute tubes from $\frac{1}{2000}$ to $\frac{1}{3000}$ of an inch in diameter, which connect the arteries and veins, and consist of a single layer of cells firmly cemented together; sometimes the finest lymphatic vessel.

Capillarity. Property of tubes of hair-like bore, when partially immersed in a liquid. Around each molecule of a fluid there is a region across which the influence of the neighboring molecules may be felt. If the molecule be further from the bounding surface than the radius of this spherical space, the forces upon it will be in equilibrium. If it be nearer the surface than this radius, there will be a resultant force generally normal to the bounding surface. Every body of liquid may then be regarded as bounded by a superficial film which acts on the inclosed mass like a stretched membrane. The tension of this film is called the "surface-tension" of the liquid. The value in dynes of the surface-tension per unit of length is called the modulus of superficial tension T. This for the surface between water and air is ab. 82 dynes per centimeter. T has been developed by stretching the film through one centimeter, and the work done or the potential energy of this square centimeter is called the superficial energy of the film. This is dependent on the nature of both media bounded by the surface. Its dimensions are $\frac{\text{energy}}{\text{area}}$ or $\frac{[M][L]^2}{[T]^2} \div [L]^2 = [M][L]^{-2}$.

Capillary actions are directly dependent upon this phenomenon of surface-tension. If one end of a capillary tube be dipped in a liquid, the latter will rise in the tube above the surrounding level and form a concave surface, or be depressed below the general level and form a convex surface, according as the liquid is or is not capable of wetting the material composing the tube. A glass tube in water illustrates the former action, in mercury the latter. The surface tension between glass and air being greater than that between glass and water, the water is drawn



Water. Mercury. Water. Mercury.

up till this force is balanced by the weight of the column of liquid. Since the glass-mercury tension is greater than the glass-air tension, the mercury is depressed. The angle at which the liquid meets the walls of the tube is called the angle of contact or of capillarity. In general, when a solid body is in contact with two fluids, there is a definite angle of contact when the tension of the surface separating the solid from one of the fluids is less than the sum of the tensions of the other two surfaces. Since this is not the fact in the case of water on glass, a drop of water on a clean glass surface will spread itself out indefinitely. The angle of contact of mercury on glass is about 45°.

Capillary Pyrites. Fine fibrous forms of millerite or of marcasite.

Capillitium. Delicate mass of slender threads found among the spores within the peridium of certain Fungi of the Truffle order and the Puff-balls, and within the sporanges of the slime-moulds.

Capital. The portion of wealth devoted to producing more wealth. The origin of capital is saving. Capital is either circulating or fixed. By fixed capital is meant houses, land and other forms of immovable wealth; by circulating capital is meant goods and materials that can be moved from place to place. Capital assumes three forms; subsistence, tools, and materials. In the evolution of capital subsistence is first in order. A person must have the means of life before he can accomplish anything. Next, tools are necessary. The knife, bow, spear, canoe and net are the tools of persons in a primitive society; afterward are used the spade, cart, plow, distaff and forge; still later are the loom, lathe, printing-press and trip-hammer; the railroads, ships and steamers may also be properly regarded as the tools of the present age. Materials are the third form of capital. These include all kinds of wealth that are devoted to producing wealth. The bait for the hook, the corn saved for seed, are materials of early industry. In a later age a large part of the accumulated wealth of the community exists in this form.

Capital. (1) Actual estate of a person or corporation; (2) Sum dedicated to a particular business.

Capital. Upper part of a column, distinguished from the shaft in treatment and commonly expanding toward the top so as to receive a load of greater area than the shaft. In some examples of Egyptian architecture, however, the capital (the "lotos-bud") is smaller at the top than at the bottom. The curve of expansion is sometimes convex as in the Doric, and sometimes concave as in the Corinthian. The principal capitals of ancient architecture were the Egyptian, Doric, Ionic, Corinthian, and Tuscan.

Capital. Right line dividing a defensive work into two similar parts; *e.g.*, that of a bastion bisects the salient angle.

Capitalist Undertakers. See UNDERTAKERS.

Capital Punishment. The death-penalty was common to all ancient nations. Murder generally called for private vengeance, often commuted with blood-money, giving rise to CITIES OF REFUGE and SANCTUARY (q.v.). Other capital crimes were visited with public vengeance which varied in cruelty with the civilization of the State. The Egyptians were as humane as the Jews were savage in administering this "lex talionis." In Greece the laws of Draco were said to be written in blood, and in Rome the laws of the Twelve Tables allowed even the creditors to dismember the debtor. Constantine ab. 330 abolished death by sharp weapons, poison, torture, starvation, hanging, mutilation, and casting from a height, but the barbarian conquests restored brutal law. In the Middle Ages the Feudal and Game Laws raised trivial offenses to capital crimes. The Church also added the stake for heresy, while somewhat lessening the number of secular victims by Benefit of Clergy. Up to 1791 French law recognized 132 capital offenses and English law 240. These numbers were not materially reduced in either country till 1832. The abolition of capital punishment has been generally urged during the present century. Russia substituted the knout under Catherine II. Holland, Portugal, Roumania, Michigan, Wisconsin, Rhode Island and Maine have abolished it. Iowa, New York, and some of the Swiss Cantons restored the penalty after having repealed it. In Belgium, Sweden, Denmark, Bavaria, n. Germany, and California capital punishment is virtually, though not legally, abolished. See EXECUTION.

Capitation Tax. A tax laid upon individuals in proportion to their income, to their rank in society, or equally upon all. The last is known as a poll tax, the former are income taxes.

Capitibranchiata. Tubicolous Annelids that carry many tentacles and tentacular cirri on the head, as in the *Terebellidæ*.

Capitol. Temple of Jupiter Optimus Maximus, on s. summit of Capitoline Hill at Rome; begun by the Tarquins, completed 509 B.C. The central chamber was sacred to Jupiter, that on the right to Minerva, that on the left to Juno. The Senate sometimes met here. The image of Jupiter was at first of terra cotta, later of gold and ivory. The temple was burned 83 B.C., and A.D. 69 and 80. The structure reared by Domitian

stood till the 5th century. On the s. side of this hill was the Tarpeian rock, from which criminals were dashed to death. The citadel was on its n. summit, where the church of Santa Maria Ara Cœli now stands.

Capitoline Games. Instituted 387 B.C. to commemorate the deliverance of Rome from the Gauls; revived by Domitian A.D. 86.

Capitoline Hill. In Rome; the CAPITOL (q.v.) and citadel were upon it.

Capitol Museum. At Rome, next in importance to the Vatican; containing the finest extant collection of Roman portrait-busts, the *Marble Faun*, *Venus of the Capitol*, *Dying Gladiator*, and many others. The new Capitoline Museum in the Palace of the Conservatori, directly opposite this building, contains the additions due to recent excavations.

Capitularies. Laws of the French kings, ab. 580–922.

Capitular Process. See PARAPOPHYSIS.

Capitulation. Act of surrender of an army or of a fortified position, in accordance with conditions previously agreed upon by the commanders of the opposing forces.

Capitulum. Dense flower cluster, the individual flowers being sessile or on very short stalks, all arising from the same point, as in Clover and Buttonwood; also called head. Also a rounded cell at the end of each manubrium in the antherid of *Characeæ*. Also, body of a barnacle.

Capo D'Istrias, JOHN ANTHONY, COUNT, 1776–1831. President of Greece, 1827; assassinated.

Cappadocia. Mountainous region in e. Asia Minor; governed by hereditary satraps under the Persians, and by kings ab. 325 B.C.–A.D. 17, when it became a Roman province.

Capparidaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising ab. 31 genera and 350 species, distributed through the warmer regions and tropics of both hemispheres; called the Caper family.

Cappel, LOUIS, 1585–1658. French Reformed divine, prof. at Saumur from 1614. His denial 1624 that the vowel points are part of the inspired Hebrew text caused much commotion. *Critica Sacra*, 1650.

Caprella. See LÆMODIPODA.

Capreolate. Tendril-bearing.

Caprera. Small island n. e. of Sardinia, later residence of Garibaldi.

Capri. Island in the Bay of Naples, ab. 18 sq. m. in extent, with precipitous sides; scene of the closing years of Tiberius.

Capri, seen from Massa Lubrense.

It has many remains of temples and aqueducts, with sea caves and grottos.

Capric Acid. $C_9H_{19}COOH$. Mpt. 30° C. Monobasic fat acid, occurring, combined with glycerine, in butter. Obtained from butter, especially goat's butter, and other fats, by saponification, and from oleic acid by distillation.

Capricorn, TROPIC OF. 23° 27′ s. lat.

Capricornus. See ZODIAC.

Caprification. Fertilization of the fig by minute insects which enter the orifice at the summit of the young fruit and moving around inside brush the pollen upon the stigmas.

Caprifoliaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising 14 genera and ab. 240 species, growing especially in the n. hemisphere; called the Honeysuckle family.

Caprimulgus. See FISSIROSTRES.

Caprivi de Caprera de Montecuculi, GEORG LEO, COUNT VON, b. 1831. Prussian general, of Italian ancestry; chancellor German Empire 1890–94.

Cap-Rock. Section of poor rock in a mineral vein, lying like a cover over the rich ore.

Caproic Acid. $C_5H_{11}COOH$. Bpt. 205° C. Known in various forms. The normal acid is a by-product in the making of butyric acid by fermentation. The so-called isobutylacetic acid is obtained by the saponification of butter and other fats. They are liquids of disagreeable odor. Found in cocoanut oil and Limburger cheese.

Caprylic Acid. $C_7H_{15}COOH$. Bpt. 236° C. Occurring in butter, cocoanut-oil, and other fats; obtained from them by saponification; liquid, easily solidifying.

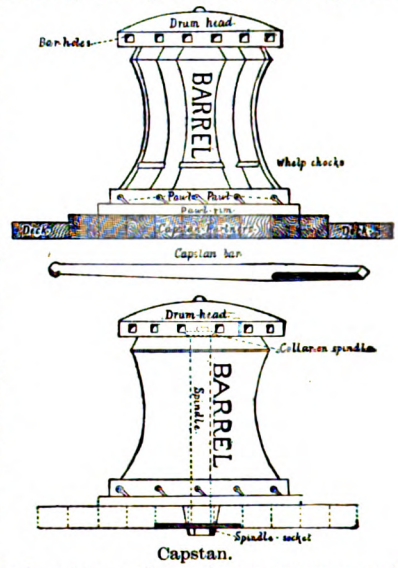
Caps. Percussion caps are small, metal covers containing detonating powder, fulminate of mercury, which, when exploded on the nipples of guns, set fire to the charge.

Caps and Hats. Rival parties of Swedish nobles 1718–51. The former favored Russia, the latter France.

Capsicum. Genus of shrubby plants of the natural family *Solanaceæ*, natives of America and Asia. Cultivated in tropical countries for their fruit, which is used in sauces, etc. In medicine it is used as a gargle, stimulant, and rubefacient. See PEPPER.

Cap-Sill. That part of the gallery frame used in military mining which connects the top of the two opposite stanchions. The corresponding bottom piece is called the ground-sill.

Capstan. Vertical windlass, having levers projecting horizontally, by which it may be turned either by men or horses. On shipboard it is used for raising the anchor and other services where great power is required. On land, for moving buildings and other heavy objects. It may be operated by steam power.



Capstan.

Capsule. Dehiscent pericarps composed of two or more carpels, as in Mallow and Rhododendron.

Capsulogenous Glands. In hypodermis of ninth, tenth, and eleventh segments of the earthworm. They secrete the horny coverings of the cocoons in which the eggs are placed.

Captain. Commissioned officer who commands a troop of cavalry, a company of infantry, or a battery of artillery; next in rank below a major and senior to a first-lieutenant. In the U. S. Army he is held responsible for the camp and garrison equipage, the arms, ammunition and clothing of his company.—In the navy, commander of a vessel, ranking below a commodore.

Captains of Industry. Employers, so called because they organize and drill the forces of labor, and direct economic operations and contests.

Caption. Beginning of a legal document, but not an essential part of it. In case of an indictment, it contains the names of the State, county, and judges, and the number of the grand jurors, with the time and place of finding the indictment. It is amendable.

Capture. Taking property by military force. Unless the captor has authority from his government his taking is piratical. Private property on land is not subject to capture by the enemy, unless of immediate use in war; but on the sea it is, except non-contraband goods laden on neutral vessels under the Declaration of Paris of 1856.

Captivity, BABYLONIAN. Ab. 606–536 B.C. After the destruction of Jerusalem by Nebuchadnezzar. This exile, from which but a small part of the Jews returned, destroyed their nationality in its full sense, but purified their religion.

Captured Property. In civilized warfare this term embraces public money, movable public property, and revenues of

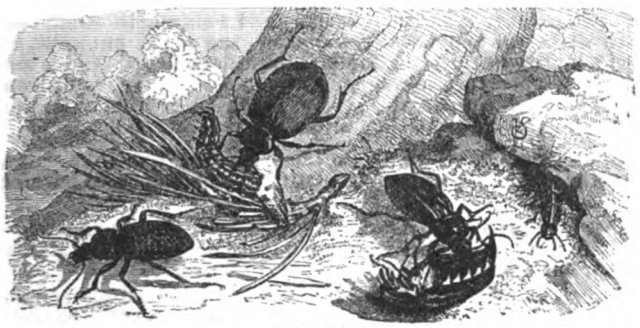
real property belonging to a hostile government; it excludes property of unarmed citizens of the enemy. There is a distinction made between the private person belonging to a hostile country and the country itself; the unarmed citizen is to be spared as far as the exigencies of war will permit. The U. S. acknowledges and protects, in hostile countries occupied by them, religion and morality; strictly private property; the persons of the inhabitants, especially women; the sacredness of the domestic relations. The right to tax people or property, to levy forced loans, to billet soldiers, to appropriate houses, lands, boats, or ships may be exercised in cases of military necessity.

Capua. Chief city of ancient Campania. It revolted to Hannibal 216 B.C., and was taken and punished by the Romans 211 B.C.

Capuchins. Austere branch of the Franciscans, founded in Italy 1525; so named from their peculiar hoods.

Capybara. See HYSTRICOMORPHA.

Carabidæ. Family of *Coleoptera*, including forms with pentamerous tarsus. They are ground beetles with powerful legs, adapted for running, and with pincer-like mandibles. The



Carabidæ.

larvæ have four jointed antennæ, four or five ocelli on each side, and five-jointed legs. The family contains more than ten thousand species. They include the beetles most commonly seen scampering away when a stone or board is lifted.

Carabobo. Plain in Venezuela, s. of Valencia. Here Bolivar, with 5,000 men, routed 6,000 Spaniards May 28, 1814, and June 25, 1821, slew or captured most of the army of De Torre, thus securing the independence of Colombia and Ecuador.

Caracalla, BATHS OF. See BATHS, ROMAN.

Caracalla, MARCUS AURELIUS ANTONINUS BASSIANUS, 188–217. Roman emperor 211–217; co-ruler one year with his brother Geta, whom he slew, with 20,000 others. He exhausted Italy, plundered the provinces, committed many crimes, and was murdered at Edessa by Macrinus.

Caracas. Capital of Venezuela; on the slope of a mountain, 3,000 ft. above the sea. The region is subject to frequent earthquakes; in that of 1812 twelve thousand persons perished. Pop. ab. 70,000.

Caracci, LUDOVICO, 1555–1619. Italian painter, founder of the school of Bologna.—His cousins, AGOSTINO, 1558–1602, and ANNIBALE, 1560–1609, were his pupils; the latter has frescoes in the Farnese Gallery.

Caractacus, d. ab. 54. British chief who fought the Romans for nine years, and in 51 was exhibited in a triumph in Rome.

Caramel. Dark-brown substance obtained by the action of dehydrating agents upon sugar, or by heating to 200° C. Also by the action of sulphuric acid upon starch; used for coloring wine and whisky, and to adulterate coffee. Also called burnt sugar.

Carapace. Upper shell of Crabs and of Turtles. In the latter, made up of a median series of neural plates developed from the spinous processes of the vertebræ, flanked on each side by eight costal plates largely made up of the expanded ribs, and finally around the edge a row of marginal plates, the anterior median one being the nuchal, the posterior, the pygal. These are all overlaid by a corresponding series of epidermal scutes, the vertebral members of the series being but half as numerous.

Carat. (1) Small seed formerly used in India for weighing diamonds. Its English equivalent is 3.1683+ grains, troy; the metric equivalent is 205 milligrammes. (2) Degree of purity of gold, or amount of gold in an alloy. Pure gold is 24 carats fine.

Carausius, MARCUS AURELIUS VALERIUS, d. 294. Belgic usurper in Britain from 287; an able ruler, who held the island against Rome till murdered by Allectus.

Caravaggio, MICHELANGELO DA, 1569–1609. Italian painter. Among his works are *Gamesters*, in Sciarra Palace, Rome; a duplicate in Dresden; *Lute Player*, in Vienna; *Deposition*, in the Vatican Gallery.

Caravan. Company of travelers in Asia or Africa, usually through the desert, for trade or pilgrimage.—Van or car of a showman or gypsy.

Caravanserai, or KHAN. Lodging-house for oriental travelers, supplied with water only.

Caravel. Small vessel of the past, such as those used by Columbus 1492. Copies of the Santa Maria, Pinta, and Nina were built in Spain and brought to the Chicago Exposition 1893.

Caraway. *Carum Carvi.* White-flowered herb of the Carrot family, native of Europe and cultivated for its seeds; introduced into the U. S.; used as a flavoring and carminative.

Caraway.

Carbajal, FRANCISCO DE, 1464–1548. Spanish officer in Peru from 1537, follower of the Pizarros; noted for activity and ferocity.

Carbamic Acid. $OC{:}OH,NH_2$. Amidocarbonic acid. The free acid is not known. The sal volatile or carbonate of ammonia of commerce contains the ammonium salt of carbamic acid, $OC{:}ONH_4,NH_2$; and the organic salts or ethers are the urethanes.

Carbamide. See UREA.

Carbanilide. $(C_6H_5NH.)_2{:}CO$. Diphenyl urea. Mpt. 235° C. Solid prepared by the action of aniline upon carbon oxychloride.

Carbazole. $(C_6H_4)_2NH$. Diphenylimide; basic compound crystallizing in plates soluble in alcohol and melting at 238° C., contained in coal tar, and found in the distillate called ANTHRACENE OIL (q.v.).

Carberry Hill. In s. Scotland; scene of Bothwell's defeat by Lord Hume, June 15, 1567. Queen Mary was taken prisoner.

Carbides. Compounds of carbon and the metals; *e.g.*, iron carbide, FeC_2.

Carbimide. OC:NH. Cyanic acid; hypothetical imide of carbonic acid, known only in its organic salts or ethers.

Carbine. Short, light musket, named from the arms with which the light horsemen (carabineer) of Henry II. of France, 1559, were armed. It is shorter than the infantry arm, and is essentially a cavalry weapon; its range and precision are less than those of the musket.

Carbinol. Methyl alcohol, CH_3OH. Triphenyl carbinol, $(C_6H_5)_3 : C.OH$; ethylmethyl carbinol, $C_2H_5.CHOH.CH_3$; derived from methyl alcohol by displacing methyl hydrogen by alcohol radicals.

Carbhydrates. See NITROGEN-FREE EXTRACT.

Carbohydrates. The compounds all contain either six carbon atoms or some multiple of six, and hydrogen and oxygen in the ratio of two atoms of hydrogen to one of oxygen, as they exist in water. There are three groups, the grape sugar, $C_6H_{12}O_6$, the cane sugar, $C_{12}H_{22}O_{11}$, and the starch, $C_6H_{10}O_5$, group. They are important and necessary articles of food, and furnish the elements for production of animal heat. They are also the fat-producers. Nearly allied to fats, but they are not mutually convertible.

Carbolic Acid. See PHENOL.

Carbon. C. At. wt. 11.94, Sp. ht. (diamond) .459. It occurs in three forms, amorphous, graphite, and the diamond, and is found in all animal and vegetable products; combined with hydrogen it forms a large number of compounds. It is used for a variety of purposes, as fuel, as a reducing agent in metallurgical processes, as a gem, etc. The carbon atoms possess in a remarkable degree the power of uniting with each other and forming thus nuclei around which organic compounds are built. It unites with four atoms of hydrogen. See COAL, GRAPHITE, DIAMOND, CHARCOAL.

Carbonado, or BLACK DIAMOND. Uncrystallized variety of diamond, dark in color and opaque, found in masses weigh-

ing several hundred carats. It was discovered in Brazil 1843, whence it is obtained; it is harder than the common diamond, and is used for diamond-drills.

Carbonari. Secret society which originated ab. 1806 in Naples, and was active throughout Italy till 1830, and extended into France.

Carbonated Waters. Natural or artificial waters containing carbon dioxide in solution; characterized by a sparkling effervescence. See CARBON DIOXIDE.

Carbonates. Salts of the hypothetical carbonic acid, H_2CO_3. Those of the alkaline bases render nearly all the secretions of the body alkaline. In the U. S., ores of lead combined with carbonic acid, and rich in silver, like those at Leadville, Col.

Carbon Chlorides. Carbon unites with chlorine in different proportions. The most common of these is carbon tetrachloride, CCl_4, formed by the action of chlorine on chloroform. Heavy liquid boiling at 77° C.

Carbon Dioxide. CO_2. Carbonic acid, carbonic acid gas; colorless gas having a faintly acid taste and odor. Sp. gr. 1.527. Liquid 0°C. 36 Atm. pressure; solid—115°C. Liquid carbon dioxide is manufactured in large quantities for use as a fire extinguisher and in soda water fountains. The gas is the principal constituent of the mixture of gases known as choke damp or after damp. It occurs free in the atmosphere and in combination in the carbonates, and is formed whenever any substance containing carbon is burned in a sufficient supply of air, by the breathing of animals, and by the slow decomposition of organic matter. It issues from the earth in many places. In the laboratory it is made by treating a carbonate with an acid. It is soluble in water, is not poisonous, but will not support life or combustion. It was discovered by Black 1757.

Carbon Diselenide. CSe_2. Similar to car bon disulphide. Liquid of disagreeable odor, irritating the eyes. Made by the action of carbon tetrachloride upon phosphrous pentaselenide.

Carbon Disulphide. CS_2. Bpt. 46° C. Combination of carbon and sulphur, obtained by the action of these elements upon each other at a high temperature; heavy liquid of unpleasant odor, used in the arts as a solvent for rubber, oils and phosphorus.

Carbon Disulphide Engine. Engine in which the vapor of CS_2 is used in the cylinder as a source of power. The liquid CS_2 is vaporized by a coil of steam pipe, condensed in a surface condenser, and pumped back into the generator. The plan was first proposed by J. H. Ellis 1872, but it has been p roved that such an engine cannot be more economical than a good steam-engine, and the odor, losses by leakage, danger from fire. amount of condensing water, and first cost of the liquid, are all objections to which water is not liable.

Carbonic Acid. $OC:(OH)_2$. Hypothetical dibasic acid, known only through its numerous salts, the carbonates, believed to be formed when carbon dioxide is passed into water. Attempts to isolate it furnish water and carbon dioxide.

Carbonic Oxide. See CARBON MONOXIDE.

Carboniferous. Series of sandstones, limestones and shales, among which occur numerous beds of coal, whence the name. Though coal is found on several other geological horizons, it is inferior to the true carboniferous coal. The scheme below may give an idea of the general order of the beds in N. America and their approximate equivalents in Europe.

On both continents the true coal measures reach a thickness of more than 12,000 ft. In both they are underlaid by a conglomerate, and lower down by a massive limestone. The genera and sometimes the species of coal-forming plants are identical in both; the coal occurs in strata ranging from many feet in thickness down to mere films. The coal-fields of Australia are remarkable for plants of Mesozoic type, indicating that continent as their aboriginal home. Few rocks exceed the Carboniferous or Mountain Limestone in the richness of their organic remains.

Great Britain.	Pennsylvania.	Ohio
Upper Coal Measures	Upper Barren Meas.	
	Upper Coal Meas.	Upper Coal Meas.
Lower Coal Measures	Lower Barren Meas.	Lower Barren Meas.
	Lower Coal Meas.	Lower Coal Meas.
Millstone Grit	Pottsville Conglom.	Ohio Conglomerate
Mountain Limestone		Maxville Limestone
Sandstones & Shales	M. Chunk Red Shale	Logan S'stone & Sh.
		Waverley Conglom.
		Cuyahoga Shale
	Pocono Sandstone	Berea Grit
		Bedford Shale

Carboniferous Limestone. Series of marine limestones lying below the coal-measures in England and called Mountain Limestone. A similar limestone occurs in N. America on the same horizon, and has been called sub-carboniferous.

Carbonite. Mineral coke.

Carbon Monoxide. CO. Sp. gr. .969. Colorless, inodorous, poisonous gas, liquefying at—141° and 35 atmospheres pressure, formed by the imperfect combustion of carbon. It burns with a pale blue flame. It can be prepared by decomposing oxalic acid with sulphuric acid and passing the resulting compounds through caustic potash solution. Solid—211°6. Discovered by Priestley.

Carborundum. SiC. Carbide of silicon produced in an electric furnace from carbon and silica. Substituted for emery. Invented by E. G. Acheson, 1891. It is crystalline and very hard.

Carboxyl. HO.C:O. Group or radical, written commonly COOH; constituent of many organic acids. The basicity of all acids containing this group depends upon the number of times it occurs in a given compound, containing no other acid radicals.

Carbuncle. Brown, hard, and extremely painful swelling, soon perforated by a number of holes through which pus is discharged, and afterward converted into an open ulcer. It most commonly occurs in the aged and feeble and those affected with diabetes, and usually found on the back, buttocks, or neck; in the latter situation it is most dangerous. Chills and a high temperature accompany it, and death may result from the severe drain upon the system it causes, or from extension of the inflammation to the brain when it is on the head.

Carbuncles. Several precious stones, red, like ruby, spinel, and garnet, named from their resemblance to burning coal.

Carburetted Hydrogen. Formerly, gaseous combinations of carbon and hydrogen; not poisonous; usually MARSH GAS or OLEFIANT GAS (q.v.). See HYDROCARBON.

Carcass. Spherical shell filled with a combustible composition, intended to be fired from a mortar or other cannon, during bombardments, to set fire to houses, shipping, etc., or to light up the position occupied by the enemy.

Carcassonne. Ancient town of s. France, on the Aude; once a seat of the Albigenses; of whom Montfort burned 400 in 1210. Pop. ab. 30,000.

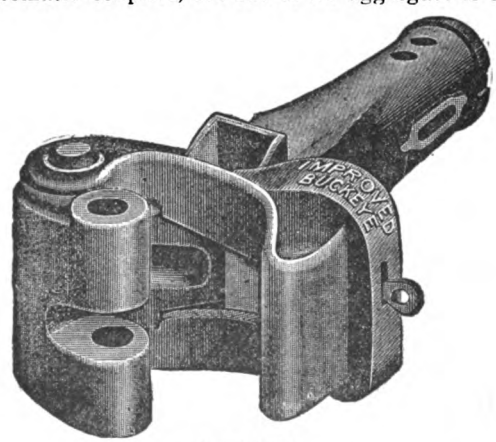
Carcerules. Portions into which a schizocarp parts at maturity.

Carcharodon. Teeth of huge Eocene Sharks, found abundantly in the marls and phosphate beds of the e. States and in Europe. Some of them are fully 6 in. long and indicate a fish 70 or 80 ft. in length.

Carchemish. Capital of the Hittites, on the Euphrates; scene of Josiah's defeat by Pharaoh Necho 611 B.C., now Jerablus.

Carcinoma. Cancer, particularly those forms in which there is an interlacing network of fibrous tissue.

Car Couplers. The old method of coupling railway cars with a link and a pin has been abandoned for passenger cars and in part for freight cars. This will be hastened by a law, passed 1893, requiring all cars employed in interstate traffic to be equipped with automatic couplers before Jan. 1, 1898. On June 30, 1893, out of 31,384 passenger cars in the U. S., 30,446 had automatic couplers, but out of an aggregate of 1,013,307



Car Coupler.

freight cars only 216,923 were so equipped. The various automatic lateral coupling devices, like that shown in the cut, are known as the Janney, Gould, M. C. B., Miller, etc., there being no less than 55 different kinds.

Cardamoms. Seeds of *Ellettaria Cardamomum*, a plant of the Ginger family, native of India; used as an aromatic and bitter tonic.

Cardan, GIROLAMO, 1501–1576. Italian astrologer and mathematician; prof. at Milan, Pavia, and Bologna; of scandalous life, but great genius. He slightly improved Tartaglia's method of solving cubic equations, and published the entire process as his own; it is still called Cardan's Rule. His great mathematical work, *Ars Magna*, was pub. 1545.

Cardan's Rule. For the reduction of a cubic equation of one unknown quantity. To reduce $x^3+ax^2+6x+c=0$ (1).

1. Transform to an equation in which the square of the unknown is wanting, by taking $x=y-\frac{a}{3}$, substituting and reducing to form $y^3+py+q=0$ (2).

2. To reduce equation (2) make $y=z-\frac{p}{3z}$, substitute and reduce to form $z^6+qz^3-\frac{p^3}{27}=0$ (3).

3. Equation (3) solved as a quadratic gives values of z^3.

4. One root being known, equation (2) or (1) become quadratic and remaining roots can be found.

5. If the roots of the cubic are all real and unequal this rule gives imaginary terms in the value of z. These can, however, be resolved by the analysis of imaginaries.

Cardan's Suspension. Device employed in suspending a barometer tube or other instrument which is required to maintain a vertical position. The case containing the tube turns about a horizontal axis fixed to a ring or thimble, which in turn is movable about a similar axis at right angles to the former one. By means of this double suspension the barometer is movable in all vertical planes, and as its center of mass is below its point of support, the position assumed will always be vertical.

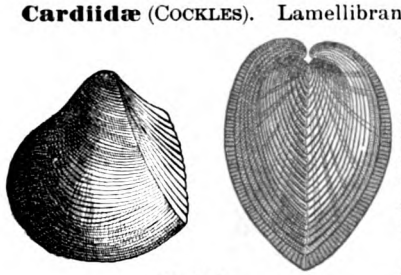
Cardboard. Stiff paper substance or pasteboard used for making boxes, cutting cards from, etc. Made by pasting together the requisite number of sheets of paper, with or without colored top-pieces, pressed, dried, and then placing smooth copper plates between the sheets and passing through rolls under pressure. Some is enameled by means of white lead rubbed on and polished.

Cardiac Ossicles. Certain teeth in the Crab's stomach. See GASTRIC MILL.

Cardialgia. HEARTBURN. Pain in the pit of the stomach of a burning character shooting into chest and throat; not dangerous; form of acid indigestion. Magnesia or bicarbonate of soda relieves it.

Cardigan, JAMES THOMAS BRUDENELL, EARL OF, 1797–1868. Leader of the charge of the 600 at Balaklava, Oct. 25, 1854.

Cardiidæ (COCKLES). Lamellibranchs with heart-shaped, arched, equivalved shell, with incurved umbones, a hinge formed of an external ligament, and several teeth. The foot is powerful and is bent like an elbow; it passes out through an anterior slit, and serves for swimming.



Cardiidæ.

Cardiff. Borough and seaport of S. Wales, one of the chief cities of the United Kingdom in the coal and iron trade. It has a castle of the 11th century; its suburb, Llandaff, is the seat of a bishopric. Anciently an important place, its pop. has increased from 2,000 in 1801 to 128.849 in 1891.

Cardinal Bird. Grosbeak, red in color, ashy on back, with chin and forehead black and with a crest; female not so bright red as male. Length ab. 8 in., tail 4½ in. A brilliant songster, nesting in cedar trees, spends much time scratching among dead leaves on the ground. It remains during the winter.

Cardinal Flower. *Lobelia cardinalis.* Scarlet-flowered and very showy plant, natural family *Campanulaceæ*, native of the e. U. S.

Cardinal Points. Gauss found that all lens problems can be simplified by reference to six characteristic points situated on the principal axis of the combination. They are, (1) "incidental focus," (2) "refractional focus," (3) "incidental principal point," (4) "refractional principal point," (5) "incidental nodal point," (6) "refractional nodal point." These are mutually interchangeable in pairs, so that (1) becomes (2), etc., when the direction of the rays is reversed. Planes through (1) and (2) and perpendicular to the axis are called focal planes. Planes through the principal points and perpendicular to the axis are called principal planes. The points (1) and (2) correspond to the principal foci of the system. The points (3) and (4) are so related that an object in one principal plane finds its image in the other equal and erect. (5) and (6) are determined by the points of intersection with the axis, of the prolongations of the incident and refracted parts of a ray which passes through the optical center of the system. In the case of a lens in air, (3) and (5) are coincident; also (4) and (6).

Cardinals. Pope's immediate senate and electors, wearing scarlet, and outranking patriarchs; either bishops, priests, or deacons, and, by dispensation, subdeacons or acolytes. They enjoy rank, but no jurisdiction, except at Rome. As a body, called College of Cardinals; sitting to receive papal communications, the Consistory; shut up to elect a Pope, the Conclave.

Cardinal Veins. Those which bring back the blood from the anterior and posterior regions of the body in fishes and early embryos of the higher Vertebrates. The anterior pair persist as the jugulars of higher forms.

Cardinal-Vicar. Pope's deputy in governing his diocese of Rome.

Cardinal Virtues. Justice, prudence, temperance, fortitude. This list dates from 400 B.C. or earlier, and omits benevolence.

Cardines. Two halves of the mentum of insects.

Cardiocarpon. Heart-shaped fossil nut, found in the Coal Measures, and believed to be the fruit of CORDAITES (q.v.), one of the earliest coniferous or cycadaceous plants.

Cardioid. Heart-shaped curve; form of the limaçon, or more generally of the Cartesian oval. Its equations are: rectangular, $(x^2+y^2)^2-4rx\,(x^2+y^2)-4r^2y^2=0$; polar, $\rho=2r\,(\cos\theta \pm 1)$. It is formed by reflection from the concave of a cylinder on an opaque fluid within. It is one of the class called "Caustics."

Cardo. Part of the first maxilla of insects, attaching it to the gula.

Cardoon. *Cynara Cardunculus.* Coarse, blue-flowered plant of the Composite family, native of the Mediterranean region, introduced and abundant as a weed in s. e. S. America.

Cards. Playing cards, which receive their English name from their being made of paper or cardboard, are among the many games of which the ancestry may be directly traced to the arrow. Their most primitive form is found in the Korean *htou-tjyen*, long strips of oiled paper comprising 8 suits of 10 cards each, with numerals from 1 to 10, and the names or representations of the animals assigned to the directions in e. Asia. The descent of these cards from the ceremonial arrow is proven by the representation of the feather of the arrow that persistently survives as a decoration on their backs. Among the Indians of America, prototypes of playing cards are found in the carved and painted staves, adorned with the totemic animals of the directions, themselves derived from the arrow, which are used at the present day in gaming by the Haidahs of the n. w. coast. The discoidal cards of the Hindus, called *gungee fa*, are strictly analogous to those of Korea, having the same number of cards and card suits, while a family resemblance may be traced in the Japanese *hana karuta*, or "flower cards," with their twelve suits corresponding with the 12 months and the 4 seasons of the year. The use of paper cards being established, their suit marks were drawn from many sources, notably in China, where we find the earliest historic record of playing cards. Chinese cards consist of paper dominoes, in multiples of 21; and of cards with suit marks derived from paper money, the game of chess, and even the child's writing lesson. The Chinese card games closely resemble those of Europe, but notwithstanding the many analogies there is no direct evidence that European cards were derived from China. The object of playing cards, whatever may be their present form, may be regarded as having been originally divinatory, while the suit marks, especially in the case of the conventional cards of Europe, may be interpreted as referring to the world quarters. The precise date of the first appearance of playing cards in Europe is uncertain. Records of them occur in the latter part of the 14th century. They became extremely popular in the 15th and 16th centuries, and their use extended over Europe and to America. A great diversity exists in European cards, of which there are two principal kinds: one comprising from 48 cards (Spain) to 56 cards (Italy), consisting of four suits of numeral and face cards, and another, variously called *tarots* (France) and *tarocchi* (Italy), in which the preceding cards are supplemented with from 22 (Venice) to 41 (Florence) cards bearing emblematic figures drawn from various sources. (See TAROTS, TAROCCHI, MINCHIATE.) The suit marks vary in different countries; in Germany, hearts, leaves, acorns, and bells; Spain and Italy, cups, money, clubs, and swords;

and France, hearts, diamonds, *trèfles* (clubs), and *piques* (spades), the English suit marks being similar to those of France. See the various games in their alphabetical places.

Carducci, GIOSUE, b. 1836. Italian poet, critic, and editor of Ariosto, Petrarch, and mediæval folk-songs; prof. Bologna 1863. *Hymn to Satan*, 1863; *Decennalia*, 1871; *Odi Barbare*, 1876.

Cardwell, EDWARD, LORD, 1813–1886. M. P. from 1842; minister in four cabinets; viscount 1874. As Sec. for War 1868–73, he abolished the purchase of commissions in the army, and brought in other reforms.

Carew, THOMAS, 1589–1639. English lyric poet.

Carey, HENRY, ab. 1696–1743. English musician, poet, and dramatist; author of the song, *Sally in our Alley*, and the play, *Chrononhotonthologos*, 1734.—His son, GEORGE SAVILLE, 1743–1807, an itinerant lecturer, composed farces and songs.

Carey, HENRY CHARLES, 1793–1879. American economist of the advanced protectionist school. *Political Economy*, 3 vols., 1837–40; *Social Science*, 3 vols., 1858–9.—His father, MATHEW, 1760–1839, came from Ireland to Phila., 1784, and pub. *Vindiciæ Hibernicæ*; 1819.

Carey, WILLIAM, D.D., 1761–1834. English Baptist, originally a shoe-maker; missionary to India 1794. He tr. the Scriptures into several native languages.

Cargo. Property on board a ship, on which freight and profits are to accrue.

Caria. District in s. w. corner of Asia Minor. Its coast was occupied chiefly by Greek colonists; the most important cities were Miletus, Halicarnassus and Cridus.

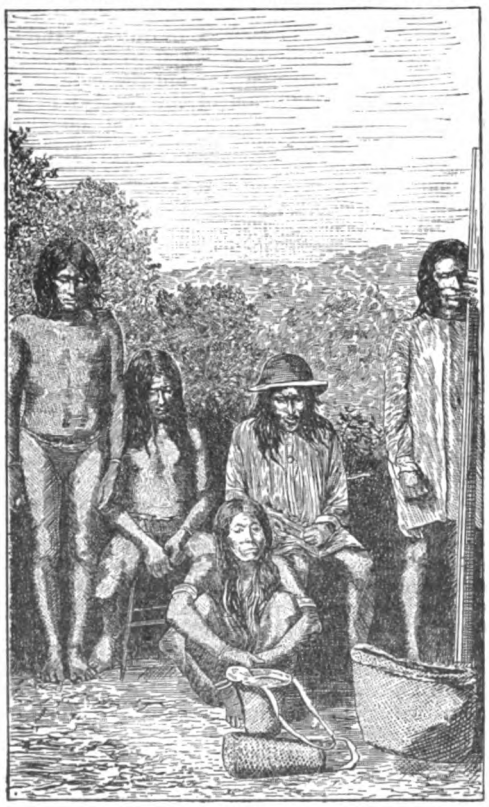
Cariacus. See DEER.

Carians. Race confined in historic times to s. w. Asia Minor, but once settled throughout the Greek Archipelago, and much employed in Phœnician service both as sailors and mercenaries. The culture discovered by Dr. Schliemann at Mycenæ has been attributed with some probability to them. A distinct C. alphabet has been collated by Prof. Sayce, but the inscriptions are not yet deciphered.

Caribbean Sea. Large arm of the Atlantic, inclosed between S. and Central America and the West Indies. Its length is ab. 1,700 m., breadth 800, and area 1,161,400 sq. m. Its mean depth is 1,269 and its maximum depth 3,169 fathoms.

Caribou. American species of REINDEER (q.v.).

Caribs. Race of Indians who in 1492 inhabited many of the W. India islands, and the n. coast of S. America from the



Caribs.

Isthmus of Darien almost to the mouth of the Amazon. Their descendants are found to-day in French Guiana and Venezuela, but chiefly in Honduras.

Caricature. Pictorial representation, either derisive or merely humorously exaggerated, of well-known subjects or personages. Extremely ancient examples are found. The Egyptian *Book of the Dead* shows us, among other satirical vignettes, rats storming a citadel manned by cats. Greek vases are rich in caricatures of stories of the gods, and Pompeian frescoes exhibit this form of mockery. Illuminated mediæval manuscripts contain much minor caricature, and wood engraving extended its use as a political weapon. This art was brought to perfection during the 18th century by Hogarth, Gillray and Rowlandson. Caricature has greatly developed since the founding of *Punch*, 1841, the English masters of the art being John and Richard Doyle, Cruikshank, Leech, Tenniel, and Du Maurier. Nast and Keppler were the best American caricaturists during this period, and France was represented by Daumier, Gavarni, Grandville, Monnier, Isabey, Cham, and many others.

Caricology. Study of the genus *Carex* of the Sedge family.

Carididæ (PRAWNS). Macrurous, decapod Crustacea, with body laterally compressed. Here belong *Penæus* and *Crangon*.

Caries. Disease of bone, in which it crumbles away in small fragments like grains of sand, and not in flakes or scales, as in necrosis. Also decay of the teeth.

Carignan. Village of n. e. France; scene of an engagement Aug. 31, 1870. The Germans turned the flank of the French, who were forced to fall back on Sedan.

Carina. Two anterior coherent petals of the flower in plants of the Pea family, known as the keel, as in the Locust and Bean.

Carina. Dorsal piece of the shell of barnacles; an elevated keel or ridge, as in the breast-bone of birds.

Carinariacea. Group of Heteropods, including forms that are slug-like, with a small shell containing the visceral hump. The mesopodium of the foot is developed into a fin; the other regions are very little developed. The ctenidia project from the small mantle-chamber.

Carinatæ (CARINATI). Sub-class of birds, having a keel (carina) to the breast-bone (sternum) for the insertion of the muscles of flight. The quill-feathers of the wings and tail are usually well developed; and almost all are able to fly. The orders included are: *Natatores*, *Grallatores*, *Gallinacei*, *Columbinæ*, *Scansores*, *Passeres* and *Raptatores*.

Carinthia. Section of Austrian empire, e. of the Tyrol, inhabited chiefly by Germans and Slavs. Area 4,005 sq. m.; pop., 1890, 361,008.

Carinus, MARCUS AURELIUS, 249–285. Elder son of Carus; Roman emperor 283–85.

Carissimi, GIACOMO, 1604–1674. Italian composer, who promoted the dramatic style by improving recitative and accompaniment; chapel master of the Ch. of St. Apollinaris in Rome.

Carlén, MME. EMILIE, 1807–1883. Swedish novelist. *Waldemar Klein*, 1838.

Carleton, WILL, b. 1845. American poet. *Farm Ballads*, 1873; *City Ballads*, 1885.

Carleton, WILLIAM, 1798–1869. Irish novelist. *Traits and Stories of the Irish Peasantry*, 1830–32; *Fardorougha the Miser*, 1839; *Rody*, 1846; *Willie Reilly*, 1855.

Carleton College. Founded at Northfield, Minn., by Congregationalists 1866; chartered 1870. It has 13 professors, 4 instructors, ab. 113 collegiate students, and 150 in a preparatory dept.

Carli, GIOVANNI RINALDO, 1720–1795. Numismatist and economist; prof. Venice 1741. *Della Moneta*, 4 vols., 1754–60; *Italian Antiquities*, 1788.

Carlile, RICHARD, 1790–1843. English radical, who vindicated the freedom of the press under repeated imprisonment and persecution.

Carlisle. Co. town of Cumberland, Eng.: destroyed 875, rebuilt 1092; seat of a bishop, with a cathedral dating from 1092. Pop. ab. 40,000.

Carlisle, JOHN GRIFFIN, b. 1835. M. C. from Ky. 1877–90, Speaker 1883–89; U. S. Senator 1890; Sec.-Treasury 1893.

Carlists. Spanish adherents of CARLOS OF BOURBON (q.v.).

Carll, JOHN FRANKLIN, b. 1828. Assistant on Geol. Survey of Pa. 1874. His work deals chiefly with the glacial geology of n. w. Pa.

Carlos of Bourbon, DON, COUNT DE MOLINA, 1788–1855. Son of Charles IV. of Spain, and heir presumptive on the death of his brother Ferdinand VII., 1830. The inheritance was disputed in behalf of Isabella, Ferdinand's infant daughter, on the ground of a pragmatic sanction. Civil war ensued. The Carlists were rejected by the Cortes 1836, and defeated 1839.—His son,

COUNT DE MONTEMOLIN, 1818–1861, and grandson, DUKE OF MADRID, b. 1848, both known as DON CARLOS, were also pretenders to the throne; their partisans were in revolt 1860 and 1870–75.

Carlotta, b. 1840. Daughter of Leopold I. of Belgium; wife of Maximilian, archduke of Austria, and emperor of Mexico 1864. She returned to Europe in 1866 and became insane.

Carlovingians. Second dynasty of French kings, beginning with Pepin, who deposed Childeric III. 752, and ending with Louis V., 987.

Carlowitz, PEACE OF. Jan. 26, 1699, between Turkey on the one hand, and Austria, Venice, Russia, and Poland on the other.

Carlsbad. Watering place in Bohemia, with abundant hot springs, 117°—167° F., containing sodium sulphate. Pop. ab. 11,000.

Carlsbad, CONGRESS OF. German ministers met July 1819, after the murder of Kotzebue, and instituted repressive measures.

Carlson, FREDERIK FERDINAND, 1811–1887. Swedish historian, prof. at Upsala.

Carlsruhe. Capital of Baden; founded 1715. It is beautifully laid out, and contains numerous public parks and gardens. Pop., 1890, 73,496.

Carlstadt, ANDREAS RUDOLF BODENSTEIN, ab. 1480–1541. Prof. at Wittenberg and colleague of Luther. He lost influence by his uneasy vanity and revolutionary restlessness, was expelled from his chair 1522 and from Saxony 1528; took part with Zwingli, and became prof. at Basel 1534.

Carlton Club. Established by the Duke of Wellington and others 1831; the present house in Pall Mall, London, was opened 1855. It is the chief Conservative club, and very exclusive, the Prince of Wales being an active member.

Carlyle, THOMAS, 1795–1881. Scottish essayist. His *Life of Schiller,* 1824; tr. of Goethe's *Wilhelm Meister,* 1824, and *Specimens of German Romance,* 1827, with many review and magazine articles, did much to introduce German literature in England. His mature genius appeared in *Sartor Resartus,* 1834; *French Revolution,* 1837; *Chartism,* 1839; *Heroes and Hero-Worship,* 1841; *Past and Present,* 1845; *Cromwell's Letters*

Thomas Carlyle.

and Speeches, 1845; *Latter-Day Pamphlets,* 1850; and *Life of John Stirling,* 1851. His later works added less to his fame, and showed increasing vehemence rather than soundness of opinion. His ideas were largely reactionary, and he grew more and more out of harmony with the spirit of his time; yet his influence 30 years ago was enormous, and largely for good. His very peculiar style is called Carlylese.

Carmel, MT. Ridge in Palestine, between Samaria and Galilee, near the sea; often mentioned in O. T. Ht. 1,750 ft.

Carmelites. Order of hermits, established 1156 on Mount Carmel, and claiming Elijah as founder; driven to Europe 1238 they became mendicant friars.

Carmen Sylva. Pen-name of the queen of Roumania, PAULINE ELIZABETH OTTILIE LOUISE, b. 1843; German princess, m. 1869 to Karl of Hohenzollern, who became king 1881. Her poems were collected in 4 vols. 1886. *Sappho,* 1880.

Carmine. See CARMINE LAKE. Also applied to other lakes.

Carmine Lake. Bronze-colored powder, prepared by precipitating an ammoniacal cochineal solution with alum. It contains the aluminum salt of carminic acid, and dissolves in ammonia water, giving a red solution.

Carminic Acid. $O_{17}H_{18}O_{10}$. Organic acid, present in cochineal, to which it imparts the valuable properties. It gives a scarlet compound with aluminum salts, and a violet compound with iron salts.

Carnac. Village of France, in department of Morbihan; famous for its Celtic monuments. On a barren moor by the sea stand ab. 1,000 rude monoliths of granite, 3 to 18 ft. high, in 11 rudely parallel rows 1¼ m. long. Other mounds and remains, some of them Roman, are found in the vicinity. By some writers these strange structures are ascribed to a prehistoric race.

Carnall, RUDOLPH VON, 1804–1874. Prussian geologist and mining engineer; founder of the Prussian official publication relating to the mining, smelting, and saline industry.

Carnallite. $KCl+MgCl_2+6aq$. Hydrous magnesium and potassium chloride, found at Stassfurt, associated with rock salt; used in the manufacture of mineral fertilizers. See STASSFURTH.

Carnassial Tooth. Last upper premolar and first lower molar tooth of Carnivora, especially adapted for cutting; hence termed sectorial.

Carnation. Species of the genus *Dianthus,* of the Pink family, natives of the Old World, extensively cultivated for their beautiful flowers.

Dianthus deltoides.

Carneades, 213–129 B.C. Philosopher, founder of the New Academy, and most extreme of the ancient sceptics. He denied the existence of any criterion for truth.

Carnegie, ANDREW, b. 1835 in Scotland. Owner of extensive iron works near Pittsburg, Pa.; founder of several libraries and music-halls; author of *Triumphant Democracy,* 1886.

Carnelian. Flesh-red, transparent or translucent, uncrystallized variety of quartz, used as a gem.

Carneospongiæ. Order of Sponges characterized by a thick mesoderm and flagellated cells restricted to special chambers on the canals. Here belong *Halisarca,* with no solid skeleton; *Spongia,* with its fibrous skeleton; *Spongilla,* with isolated, and *Euplectella,* with connected siliceous spicules. See PLETHOSPONGIÆ.

Carnifex Ferry. In Nicholas co., Va. Here Rosecrans attacked the Confederates Sept. 10, 1861; they retreated in the night.

Carnival. Time between Epiphany and the beginning of Lent, especially the last week, which is observed with sport and merriment in many parts of Europe and in New Orleans. It originated in the ancient heathen festivals.

Carnivora (FERÆ). Order of deciduate placental mammals, having teeth and claws adapted to feeding on animal prey. The skull is short and rounded with large zygomatic fossæ for the masseter muscles, which close the jaws. The mandibular condyle is rounded and transversely elongated, permitting jaw movements only in the vertical direction. The dentition is complete: nine incisors, four well-developed canines, and a variable number of præmolars and molars which vary from sectorial to tuberculated character, are present. See CARNASSIAL TEETH. The toes are unguiculate, the feet usually pentadactylous, the mode of progression various. The placenta is zonary, the mammæ abdominal, and the uterus two-horned. They are found over the earth's surface, except in Australia, where carnivorous Marsupials take their place. Numerous fossil forms are found beginning in the Eocene. There are two great sub-orders, the *Pinnipedia* (Aquatic Carnivora), and *Fissipedia* (Terrestrial Carnivora).

Carnivorous Dentition. Incisors, canines, premolars, and molars, all developed and having crowns furnished with irregular and sharp or pointed tubercles that slope to the gums.

Carnochan, JOHN MURRAY, M.D., 1817–1887. Prof. of surgery in N.Y. Medical College 1851; noted for bold and original operations.

Carnot, LAZARE NICOLAS MARGUERITE, 1753–1823. Organizer of the French revolutionary armies; member of the Committee of Safety 1793–95, and of the Directory 1795–97; minister of war 1800; defender of Antwerp 1814.—His *Memoirs,* 1861–64, were pub. by his son LAZARE HIPPOLYTE, 1801–1888, deputy

1840–48, 1864–68, 1871–75, senator 1875.—Another son, NICOLAS SADI, 1796–1832, wrote on thermo-dynamics.

Carnot, MARIE FRANCOIS SADI, 1837–1894. Fourth president of the French Republic; grandson of the first Lazare; commissary-general during siege of Paris, 1871; deputy 1871; finance minister 1882 and 1886; pres. Dec. 1887; assassinated at Lyons by an Italian anarchist, June 24, 1894. He was a judicious and exemplary official.

Carnot's Cycle, or PRINCIPLE. Enunciated by Nicolas Sadi Carnot 1824, that the ratio of maximum effect to the total heat expended in a perfect heat-engine is a function solely of the two constant temperatures at which heat is received and rejected by that engine. Or, otherwise, if a closed curve on a plane of co-ordinate axis represent by its ordinates the succession of pressures when the external pressure is at each instant equal to the elastic force of a gas, the exterior work is the dynamic equivalent of the heat supplied to and abstracted from the gas during the cycle represented by such curve. The perimeter of such a curve may be conceived as a polygon made up of infinitesimal sides, which are successively isothermal and adiabatic curves.

Caro, ANNIBALE, 1507–1566. Italian poet and tr. *Æneid. Letters,* 1572–75.

Caro, ELME MARIE, 1826–1887. Called "the ladies' philosopher"; prof. at the Sorbonne from 1867, Academician 1876; an elegant and highly popular lecturer, who mainly followed Victor Cousin.

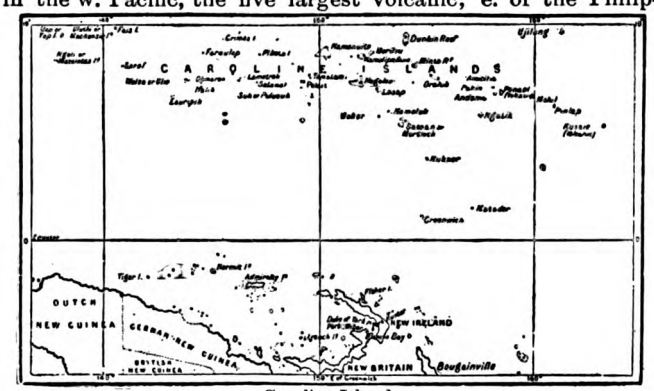
Carob. Small, bushy tree of the *Leguminosæ, Ceratonia siliqua,* native of the Mediterranean region. Its pulpy pods are used as food for cattle and swine. Known as St. John's Bread.

Carolina. See NORTH CAROLINA and SOUTH CAROLINA.

Caroline, AMELIA ELIZABETH, 1768–1821. Niece of George III., married 1795 to the Prince of Wales, who left her 1796, and on his accession 1820 had her accused of adultery. She was supported by popular sympathy, defended by Brougham, and acquitted.

Caroline Books. Set forth by Charlemagne to correct the errors of 2d Synod of Nicæa 787. They allowed images and pictures in the churches, but not to be worshiped.

Caroline Islands. Group of ab. 500 small coral islands in the w. Pacific, the five largest volcanic; e. of the Philippines; discovered 1527; annexed to Spain 1686; vainly claimed by Germany 1885. Pop. ab. 36,000.



Caroline Islands.

Carols. Songs, mostly for Christmas; often of great antiquity; first collected in English 1521.

Carolus-Duran, CHARLES AUGUSTE EMILE, b. 1837. French portrait painter.

Carotid Artery. See ARTERIES.

Carotid Gland. Body situated on the carotids of the frog to offer resistance to the blood-flow into the brain until the other vessels have received the more venous blood.

Carp. See EVENTOGNATHI.

Carpaccio, VITTORE, ab. 1450–ab. 1522. Venetian painter of art slightly archaic, but naive and ingenuous. His best-known work is the series for the Life of Saint Ursula in the Venice Academy.

Carpathian Mountains. Range of s. Europe. Commencing in n. Hungary, it trends s. e. and then s. w., forming most of the Roumanian boundary. It thus forms a great curve, inclosing the plains of Hungary. Its peaks reach a ht. of nearly 9,000 ft., with the limit of forests at ab. 6,000 ft.

Carpeaux, JEAN BAPTISTE, 1827–1875. French sculptor, scholar of Rude. *Dancers,* on the Paris Opera House; *France Protecting Agriculture and Science,* in the Louvre; *Four Quarters of the Earth,* on the Luxembourg Fountain.

Carpel. Division of a compound pistil, resulting from the fusion of several leaves in the metamorphosis of the flower; called Carpid and Carpophyll. Term also applied to a simple pistil.

Carpentaria, GULF OF. Large inlet from Indian Ocean into n. shore of Australia.

Carpenter, FRANCIS BICKNELL, b. 1830. American portrait painter. His *Emancipation Proclamation* is in the Capitol at Washington.

Carpenter, LANT, LL.D., 1780–1840. Pastor at Bristol from 1817. *Unitarianism,* 1809.—His daughter MARY, 1807–1877, was active in reform schools and other philanthropic labors.

Carpenter, WILLIAM BENJAMIN, LL.D., F.R.S., 1813–1885. English physiologist whose labors among lower organisms have been of inestimable aid to geologists; son of Lant. His name is associated with the controversy concerning Eozoön Canadense and with the deep-sea researches of the *Challenger* expedition.

Carpenter-Bee. Different species of hymenopterous insects, resembling the bumble-bee, of the genus *Xylocopa.* They build their nests in partly decayed wood by boring into it.

Carpentry. Art of cutting, framing and joining timber. It is essentially confined to the construction of houses and ships, the more delicate operations of wood-working coming under the head of joinery and cabinet-making.

Carpet-Baggers. Northern men who settled in the South after the Civil War, 1865; especially those who sought political advancement by means of the negro vote.

Carpets. Fabrics of woven hair or wool. The distinction between carpets and hangings or tapestries is modern and Occidental. Carpets were used in ancient Egyptian temples and palaces as in modern Oriental mosques and dwellings. The carpets of the luxurious Greeks, even in the Homeric Age, were very magnificent, being probably of Babylonian origin, as in later times Babylonian carpets were eagerly sought in Greece and Rome. To the present day Persian carpets have never lost this pre-eminence. The conquests of the Arabs introduced them into Europe, and in mediæval pictures we see carpets of marvelous color and design. The finest examples are held in the East at practically prohibitory prices. South Kensington Museum recently acquired one for $15,000. The manufacture of Turkey carpets was begun in France at Beauvais 1664, and at Mortlake in England 50 years earlier. The development of carpet-weaving has since been constant and universal.

Carpet-Weed. *Mollugo verticillata.* Spreading herb of the natural family *Aizoidaceæ,* native of tropical America, but widely diffused as a weed; called Indian Chickweed.

Carpholite. Straw-colored mineral, containing alumina, magnesia, silica and water; of rare occurrence.

Carpid. See CARPEL.

Carpio, MANUEL, 1791–1860. Mexican statesman and poet. He wrote chiefly on biblical topics.

Carpocrates. Alexandrian Gnostic, ab. 130; founder of a sect noted for immorality.

Carpogone. Female organ of reproduction in certain Algæ and Fungi.

Carpolite. Fossil fruit.

Carpophaga, or SCANDENTIA. Tribe of Diprotodont Marsupials, with feet adapted for climbing. The second and third toes of the hind foot are fused; the inner toe is without nail,

Phascolarctus cinereus.

and is opposable like a thumb. The tail is usually long and prehensile, as in monkeys. Some (as in the group *Edentula*) are sloth-like; others (*Phascolarctus,* the Native Bear) are of

unwieldy shape, have large ears and a rudimentary tail; and still others, as the *Phalangers*, possess a patagium, as in flying squirrels.

Carpophore. Torus of a flower, prolonged and forming a central axis to the carpels, as in Geranium.

Carpophyll. See CARPEL.

Carpophytes. Plants which produce a carpogone.

Carpopodite. Third of the five joints of the endopodite, or fifth in the walking legs (counting outward) of crabs and lobsters.

Carposperm. Fertilized oösphere of the *Florideæ* or Red Algæ.

Carposporeæ. Most complex of the three divisions of the Thallophyta, proposed by Sachs, containing such Algæ and Fungi as produce carpospores.

Carpospores. Reproductive bodies of certain Algæ and Fungi.

Carpus. Human wrist; or, more properly, eight bones forming it. As to insects, see PTEROSTIGMA.

Carpzov. BENEDICT, 1595–1666. Prof. at Wittenberg, and writer on jurisprudence. His brother, JOHANN BENEDICT, 1607–1657, prof. at Leipzig 1643, was an eminent theologian, as were his son and namesake, 1639–1699; his grandson, of the same name, 1720–1803; another son, SAMUEL BENEDICT, 1647–1707; and Samuel's son, JOHANN GOTLOB, 1679–1767, prof. at Leipzig and a great biblical critic.

Carrageen. See IRISH MOSS.

Carrara. Italian town 133 m. n. w. of Pisa. There are more than 400 marble quarries in the neighboring hills, and for 2,000 years this marble has been in request for statuary, and is exported to all parts of the world. Pop. 30,143.

Carrel, ARMAND, 1800–1836. Ed. Paris *National* from 1830.

Carrer, LUIGI, 1801–1850. Italian poet.

Carrera, JOSE MIGUEL DE, 1785–1821. First pres. of Chili, 1812–3; afterward engaged in futile insurrections.

Carrera, RAFAEL, 1814–1865. Guatemalan revolutionist, pres. or dictator 1847–8 and from 1851.

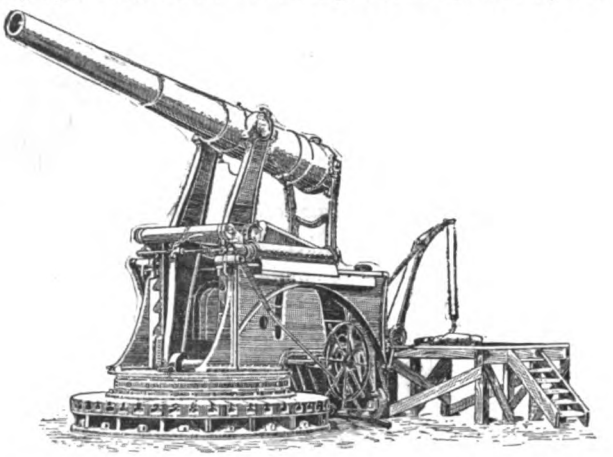
Carriage. Generally a vehicle on wheels for the conveyance of persons. Its precise signification depends largely on its context. Hence it has been held by courts to include a sled loaded with coal, and a bicycle, but not a railroad car.

Carriages. Wheeled vehicles were used by all the civilized nations of antiquity. Chariots were used in the circus, for war, and the chase. The sculptures also show Egyptian gentlemen driving horses in curricles and princesses journeying in state chariots drawn by oxen. The fashionable Athenian woman drove out with her husband, and even in Sparta young ladies joined religious processions in griffen-shaped vehicles called "canathra." In Rome ladies drove the "pilentum." The "cisium" was a two-wheeled covered vehicle for hire, and the "petorritum" was a four-wheeled public conveyance drawn by mules. In the Middle Ages carriages were considered effeminate for men, but illuminated MSS. prove that women used them extensively. In 1294 their extravagant equipage called forth sumptuary edicts in France. These charettes had side panels and tilts covered with painted leather, or even lead. One of these containing Anne of Bohemia's maid of honor was upset on London Bridge in 1392 in the rush to see the queen. The whirlicote, a kind of state carriage, was used by the wife of the Black Prince 1370, and as late as the marriage of Catharine of Arragon 1501. Coaches were introduced from Hungary and were generally used early in Elizabeth's reign. They were square lumbering vehicles and were little improved for two centuries. For different kinds of carriages see under their respective titles.

Carriages, ARTILLERY. Field and siege carriages are generally wheeled, and are intended to support the guns in firing and to transport them with their ammunition and necessary supplies. Sea-coast guns are mounted on fixed carriages of great strength and resisting power. The requisites sought for are sufficient strength to withstand the force of explosion, security and reliability in the service of the gun, rapidity in loading and accuracy in pointing; great mobility also is needed for field artillery. For mountain artillery service the gun and its carriage are so contrived as to weight and bulk that they may be carried on mule back and assembled on their wheels when used. The 5″ siege gun and 7″ howitzer are mounted on wheeled carriages of stronger construction than the field carriages. Recoil is checked by hydraulic buffers; trunnion beds are 6 ft. above the ground, giving ample protection to the gunners behind the parapet over which guns fire. The 7″ howitzer rests in sliding trunnions whose recoil is limited to about 6 inches by means of front buffers, and rear Belleville springs. The 7″ siege mortar carriage rests on solid platform, the mortar being supported in sliding trunnions having limited recoil. The platform is furnished with three traverse and two clamping circles for maneuvering; elevation is given by pinch bar.

Sea-coast carriages are of three kinds: Barbette, when the piece is to be fired over a parapet and remain in its position; Casemate or Turret, when fired through a port or embrasure; Disappearing, when intended to be fired over a parapet and to return behind and below it on recoil, after firing.

The great cost of modern guns has brought about the invention of disappearing gun carriages, to minimize the danger of injury by a hostile shot. Two designs have successfully with-



Artillery Carriage.

stood the severe service tests for U. S. coast defense. One, a front-pintle carriage for the 8″ gun, the Crozier-Buffington, and the other a center-pintle for the 8″ and 10″ guns, designed by Captain Gordon. In both designs the guns are loaded under cover and are easily raised by the energy stored in the recoil to the firing position; they have a wide field of fire, are easily maneuvered, and can fire a round in two or three minutes or less. In England, the Moncrieff designs have been developed into the Elswick hydropneumatic carriage which, so far, is practically the only one on the disappearing system which has reached much success beyond the experimental stage.

Carrickfergus. Seaport of co. Antrim, Ireland; taken by the French 1760. Paul Jones took a prize in its bay April 24, 1778. Pop. ab. 10,000.

Carrier, JEAN BAPTISTE, 1756–1794. French terrorist, who at Nantes executed some 16,000, mostly by drowning; guillotined.

Carrier, COMMON. Transporter of persons or goods for all who apply. He is liable for all loss or damage to goods in his possession, except that occasioned by act of God, as a tempest; by the public enemy, as by military capture; by act of the law, as by seizure under legal process; by the fault of the shipper, as by improper packing or direction. He may be sued either for breach of his contract, or in tort for breach of his common law duty to carry safely, in case the goods have been received by him and lost or damaged. If he refuses to receive goods which he is accustomed, and has the facilities, to carry, he is liable in tort. He is not the insurer of passengers as he is of goods, but is bound to carry them safely, and is charged with the utmost care and skill in performing this duty; he must do his best and keep all the instrumentalities of transportation in safe condition, and must adopt improved appliances and methods as soon as practicable. He is liable for the negligence of his servants. Whether he may validly contract with a passenger for exemption from liability for negligence is a subject on which the courts differ.

Carrière, MORITZ, b. 1817. Prof. Giessen 1849, Munich 1853; author of works on æsthetics, philosophy, and religion.

Carrières, LOUIS DE, 1662–1717. French Oratorian. His Commentary, 1701–16, is still used.

Carrier Pigeon. Strictly a fancy breed distinguished by excessive length of head and beak and enormous wattles round beak and eyes. The courier pigeon is of Belgian stock and, unlike the above, is bred for speed alone, the record being 150 miles in two hours. The use of the homing instinct is very ancient, as the story of Noah's dove shows. Brutus and Hirtius corresponded by pigeons at the siege of Modena, and Taurosthenes sent news of his victory in the Olympian Games by this means. The Arabs were the first to establish a regular pigeon-post between Alexandria, Aleppo and Bagdad. In modern times the success of this communication during the siege of Paris (1870–71), has turned the attention of European governments to the systematic training of pigeons. In 1871 the birds were taken out of

Paris by balloon and could only be used for returning, but now they are taught to fly from fortress to fortress for their morning meal and back again for supper. Microscopic photography enables one bird to carry five million words. There are about 60 military pigeon depots in Europe.

Carrière, JEAN, 1856–1894. French potter and sculptor; inventor of a new earthenware, *grès.*

Carrion Birds. American Vultures (*Cathartidæ*), some *Falconidæ*, and a New Zealand Cockatoo. *Cathartes atratus*, the Carrion Crow of s. U. S. cities, is ab. 2 ft. long, nearly black, neck bare except behind, tail square, and while flying, frequently flaps wings. Turkey Buzzard, *C. aura*, has neck bare all around, rounded tail, and sails in flight, eggs laid on ground. *C. Californianus*, Californian Vulture, rivals in size the CONDOR (q.v.). The Caracara Eagle (*Polyborus tharus*), of S. America to Texas, attacks weak and young animals besides dead ones. It has webs between outer, middle and inner toes. Common Carrion Buzzard of S. America, *Milvago chimango*, also does not hesitate to attack live domestic animals. It is a better runner than flyer.

Carrion Flower. *Smilax herbacea.* Vine of the natural family *Liliaceæ*, native of e. N. America, whose flowers exhale the odor of decaying animal matter. Also species of *Stapelia*, plants of the Milkweed family, mainly natives of S. Africa.

Carroll, CHARLES, OF CARROLLTON, 1737–1832. Signer of the Declaration of Independence; M. C. 1777–79; U. S. Senator from Md. 1788–93.—His cousin, JOHN, D.D., LL.D., 1735–1815, was R. C. Bp. of Baltimore from 1790, Abp. 1808, and founder of Georgetown Coll. 1791.

Carroll, LEWIS. See DODGSON, CHARLES L.

Carrollite. Co_2CuS_4. Copper and cobalt sulphide, found in Carroll co., Md.

Carronade. Short, trunnionless cannon of large caliber, for use on shipboard in firing shells; invented by Gascoigne 1799, and first cast at the Carron Iron Works in Scotland.

Carron Oil. Mixture of equal parts of lime water and oil, usually linseed, used in the treatment of burns.

Carrot. *Daucus Carota.* Herb of the natural family *Umbelliferæ*, native of the Old World, widely diffused as a weed and cultivated for its fleshy nutritious roots; grown sparingly as a food for stock, especially horses. The culture is the same as for beets, except that the young plants are slower in starting. The wild carrot is of the same species, escaped from cultivation, and is a bad weed, especially in grass lands, from which it is almost impossible to eradicate it.

Carrot Tree. *Monizia edulis.* Large rooted plant of the Carrot family, native of Madeira.

Carruthers, WILLIAM. b. 1830 in Scotland. Keeper of Botanical Department of British Museum. He has conducted many original investigations on fossil plants, pub. numerous memoirs on fossil botany, re-edited Lindley's *Fossil Flora*, and supplemented it with an account of the fossil plants of Britain.

Cars. The total number of cars on U. S. railroads in 1893 was 1,273,946, of which 31,384 were passenger cars, and the remainder freight cars. There were 53 cars for each million passengers carried, and 1,613 for each million tons of freight carried. The number of passenger locomotives was 8,957, ab. 1 for every 4 cars; that of freight locomotives was 18,599, ab. 1 for every 6 cars.

Carson, ALEXANDER, LL.D., 1776–1844. Irish Presbyterian who became an Independent 1804, and received immersion 1814. *Baptism*, 1831.

Carson, KIT, or CHRISTOPHER, 1809–1868. Fremont's guide in his western journeys; later in U. S. army.

Carson Lake. In w. Nevada; sink of Carson R. Area ab. 300 sq. m.

Carstares, WILLIAM, D.D., 1649–1715. Chaplain and agent of William III. while Prince of Orange; principal Univ. Edinburgh 1703. He promoted the Revolution and the Union, and exerted vast influence in Scotland.

Carstens, ASMUS JAKOB, 1754–1798. Leader of the classic Greek Revival in German art, best known by paintings and drawings in the Museum of Weimar. His position in painting corresponds to that of Thorwaldsen in sculpture and of Schinkel in architecture.

Cartagena. Seaport of s. e. Spain; founded as Carthago Nova 242 B.C.; taken by Scipio 210 B.C. It has a fine harbor. Pop. ab. 90,000.

Cartagena. Seaport of Colombia, on an island of the Caribbean Sea; founded 1533; sacked by Drake 1585. Spain spent vast sums on its defenses, besieged it for four months, 1815, after the revolt, and held it till 1821. It has a good harbor and a declining commerce. Pop. ab. 12,000.

Carte-Blanche. Authority given to a commander of an army to conduct military operations without restriction from the home government. For the time being supreme authority vests in the general, but this does not of necessity free him from responsibility in any subsequent investigation of his conduct of affairs.

Cartel. Agreement for exchange of prisoners between belligerents.

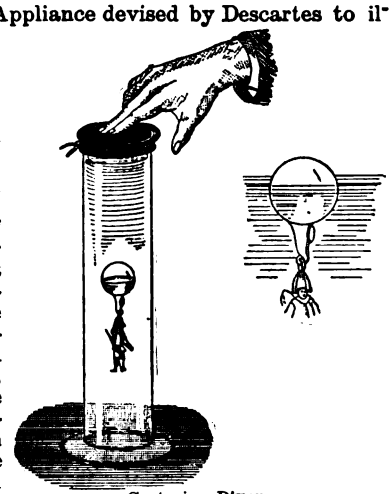
Carter, ELIZABETH, 1717–1806. English poet. Her tr. of *Epictetus*, 1758, was long in use, and is the basis of that of T. W. Higginson, 1865.

Carteret, JOHN. See GRANVILLE, EARL.

Carteret, PHILIP, d. 1796. English sailor, who discovered Pitcairn's and other islands 1767–8, and circumnavigated the globe.

Cartesian Co-ordinates. System named from Descartes, who first developed it. In its planer form positions are referred to two straight lines, called axes, in the plane intersecting at a point called the origin. Positions are determined by measurements on or parallel to the axes. Measurements to the right or above are positive, those to the left or below are negative. The direction of any point from the origin is determined by the signs of the co-ordinates considered together. If the axes intersect at right angles, the system is rectangular, otherwise it is oblique; and the angle of intersection (axial angle) must be known, as its functions will enter into the relations of the co-ordinates.

Cartesian Diver. Appliance devised by Descartes to illustrate the principle of Archimedes. It consists of a small glass bulb weighted so as to float in water in an upright position. There is an opening in the bottom, and the bulb is filled partly with water and partly with air. There is just enough of the latter so that under the ordinary pressure it floats in water, nearly immersed. If the pressure on the surface be increased, more water will be forced into the bulb, compressing the air in the top. The whole, becoming now heavier than water, will sink. If the pressure be regulated carefully, the diver may be held in any position desired.



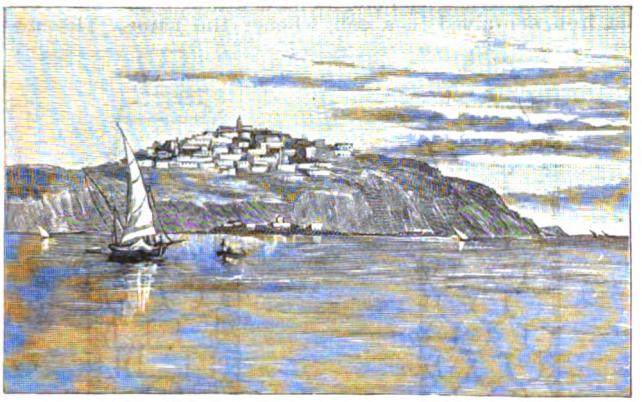
Cartesian Diver.

Cartesian Philosophy. See DESCARTES.

Cartesian Vortices. Basis of the theory of Descartes concerning the planetary system; the sun being supposed to be the center of an immense primary vortex in which the planets whirl, and each planet the center of a secondary vortex in which the satellites move.

Carthage. City of n. Africa, founded by Phœnicians ab. 850 B.C., according to the legend by Dido, a princess of Tyre. It was on a peninsula, and, at height of its power, ab. 15 m. in circumference. No record of its early history remains. By 410 it ruled n. Africa, except Utica, from the Great Syrtis to the pillars of Hercules, besides Sardinia, Malta, and the Balearic Islands, and had colonies in Spain and Gaul. Ab. 500 B.C. occurred the expedition of Hanno to found colonies in w. Africa, and another under Himilco to explore the Atlantic, resulting in the discovery of Britain. Ab. 480, co-operating with the Persians in their attack on the Greeks of Attica, it sent an expedition to Sicily with 3,000 ships and 300,000 men, but were badly beaten at Himera by Gelo of Syracuse. Ab. 410 it renewed the attempt, and by 398 had subjugated the island except Syracuse, in the fruitless siege of which it lost 150,000 men by pestilence. Timoleon fought it for six years, and in 340 inflicted a crushing defeat at the Crimissus. Agathocles of Agrigentum transferred the war to Africa 310, and reduced it to extremities, but was recalled by a revolt at home. In 264 began the first of the wars with Rome; it ended 241 in defeat. Sardinia was lost 237. The second Punic war, 218–202, was waged in Italy, Spain, and Africa, and ended with the battle of Zama and the prostration of C. A period of internal dissension succeeded, followed by the third Punic war, 149–146, for which the Romans invented a pretext. At its close, C. was destroyed. It was twice colonized from Rome, 122 and 29 B.C.; it soon rivaled Alexandria, and in the 3d century stood next to Rome

in wealth and population. It was taken by Genseric 439, and made capital of the Vandal kingdom; stormed by Belisarius 533, and finally destroyed by Arabs 706. Few traces of its greatness remain; among these are arches of an aqueduct once 50 m. long. The constitution of C. was aristocratic, with two



Village Saidi Bou Said, site of Ancient Carthage.

kings, or suffetes, who presided over the senate. The people were consulted when suffetes and senate differed. There was also a Council of Ten, chosen from the senate, who controlled the acts of the suffetes and directed all departments of the administration.

Carthage. Capital of Jasper co., Mo. Here 1,500 Federals under Sigel unsuccessfully attacked 3,500 Confederates under Price, July 6, 1861.

Carthamin. $C_{14}H_{16}O_7$. Insoluble red coloring matter derived from the dried florets of safflower, *Carthamus tinctorius*, a thistle-like plant found in sub-tropical countries. Sold as Safflower Carmine, a thin aqueous paste; mixed with starch or talc it is used as a cosmetic.

Carthusians. Austere French monastic order, founded by St. Bruno 1084. Its main seat is La Grande Chartreuse. Ab. 1700 it had 170 houses; there are now few.

Cartier, JACQUES, 1494–ab. 1552. Seaman who in 1534 discovered the mainland of Canada and claimed it for France. In 1541 he was sent back with five ships and built a fort near the present site of Quebec.

Cartilage. Elastic animal tissue, next in hardness to bone, which covers the ends of bones in joints, takes their place in various situations, *e.g.*, the larynx, and from which most of the bones originate in fœtal life and under certain conditions absorbs lime salts in adult life and becomes dense and bonelike. In certain fishes it constitutes the entire skeleton.

Cartilaginous Cranium. Earliest form of the skull, before any ossifications of bone occur in it. The adult skull contains also a series of membrane-bones soldered on the outside of the cartilaginous cranium. The cartilaginous cranium consists of the parachordals, trabecula cranii, sense capsules, and processes sent out from these cartilages, that grow up over, and more or less inclose, the brain.

Cartomancy. Divination with playing cards; practiced in Europe from ab. 1520. It seems to have lost favor among the upper classes until ab. 1750, when it was revived by a perruquier in Paris, Alliette, who may be regarded as the founder of the present systems. The cards known by the Italians as Tarocchi, which have 22 extra cards, are thought to be most suitable for the purpose. The emblems on these numbered cards have been regarded as derived from an Egyptian source, and again, to have contained a revelation of the Hebrew kabbalah. These appear to have originated in the 21 natural dominoes formed by combining two dice.

Cartoon. Drawing on paper, occasionally colored, as preliminary design for a wall-painting or tapestry, and hence generally large. They were always made by Italian fresco-painters, and some have great celebrity, *e.g.*, those of Raphael in S. Kensington Museum, London. Also, a caricature or other sketch.

Cartouch. Leather bag used by an artilleryman to carry the ammunition from the limber to the gunner. In siege battery service a box.

Cartouche. Oval line, framing the hieroglyphic name of an Egyptian king.

Cartridge. (1) Receptacle, usually cylindrical and watertight, to hold the explosive material in blasting. (2) Hydraulic cartridges and lime cartridges, used in fiery coal-mines; are similar in shape, but the rending of the coal is effected by water-pressure, or by the expansion of quick-lime when wet. (3) Formerly the charge for firing a gun was poured in as loose powder and pressed down by a rammer; afterward it was confined in a paper case for small arms; for cannon a flannel or merino bag held the powder charge. Recently metallic cartridges have almost entirely replaced the older forms.

Cartwright, EDMUND, 1743–1823. English rector, inventor of the power-loom for cotton-mills, 1785.

Cartwright, JOHN, 1740–1824. English reformer, fined 1820; voluminous writer.

Cartwright, PETER, D.D., 1785–1872. American Methodist, evangelist in the West.

Cartwright, THOMAS, ab. 1535–1603. English Puritan, prof. Cambridge 1569–71; imprisoned, and long in exile.

Cartwright, WILLIAM, 1611–1643. English playwright and poet, much admired in his day.

Caruncle. Fleshy excrescence on the head of a bird, as the comb and wattles.—In botany, small protuberance at or around the hilum of a seed.

Carus, JULIUS VICTOR, b. 1823. Prof. Leipzig 1853. *Morphology*, 1853; *Hist. Zoölogy*, 1872.

Carus, KARL GUSTAV, 1789–1869. German physiologist; prolific writer.

Carus, MARCUS AURELIUS, 230–283. Roman emperor 282. He defeated the Sarmatians, and died on his way to Persia.

Carvacrol. $C_3H_7.C_6H_3:CH_3,OH$. Bpt. 236° C. Propyl-methylphenol. Cymolphenol. Prepared by heating camphor with iodine or from carvol; present in oil of cumin. Thick oil.

Carver, JOHN, ab. 1575–1621. First Governor of Plymouth, Mass.

Carving. Art of cutting bone, ivory, horn, wood, or stone; but the latter is usually called SCULPTURE (q.v.). Its extreme antiquity is proved by the implements of the Cave-men, and the whole history of buried Oriental monarchies is recovered by its means. Egyptian carved wood statues exist dating from 4500 B.C., and our museums are full of delicate ivories and elaborate furniture and arms of all ages from Egypt, Assyria, Greece, Etruria, and Rome. In Byzantium ivory-carving was brought to a high state of excellence, chiefly in the service of the Church, and beautiful examples exist of Italian and Spanish workmanship of the 13th and 14th centuries. Germany, Italy, Holland, Spain and Flanders were specially famous during the 16th century; and great artists, like Raphael and Benvenuto Cellini, carved in ivory. In intricate dexterity, however, the ivories of India, China, and especially Japan, surpass those of European workmanship.

Wood-carving was used from the earliest times for the adornment of temple and palace. In Gothic buildings, rood-screens, pulpits, stalls, misereres, shrines, roofs, brackets and gables still show the taste and skill of the Mediæval carvers. At the Renaissance profuse domestic ornamentation was introduced, and the museums are full of furniture lavishly carved from the days of Leonardo, Michelangelo and Raphael, down to the work of Grinling Gibbons.

Carvosso, WILLIAM, 1750–1834. Cornish class-leader from 1774.

Car Wheels. First used on tramways in 18th century; they were like wagon wheels, and were guided by grooves or flanges in the rails. Flanges were introduced 1789. Car wheels are usually of cast iron with the cylindrical surfaces toughened or chilled. The average life of a wheel is from 1 to 3 years, or ab. 50,000 m. traveled in passenger service, or less than one-half this distance in freight service.

Cary, ALICE, 1820–1871. American poet and novelist. *Clovernook*, 1851–53–54; *Hagar*, 1852.—Her sister PHŒBE, 1824–71, was closely associated with her in life and death. She pub. *Poems*, 1854–67. Her familiar lyric, *One Sweetly Solemn Thought*, was written 1852.

Cary, ANNIE LOUISE, b. 1842. American contralto singer, who began her operatic career 1869 and retired at the height of her fame on her marriage to C. M. Raymond 1882.

Cary, HENRY FRANCIS, 1772–1844. English translator of Dante's *Divina Commedia*, 1806–14.

Cary, LUCIUS. See FALKLAND.

Caryatides. Female figures used as columns.

Caryophyllaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Polypetalæ*, comprising ab. 45 genera and 1,200 species, widely distributed throughout the earth; called the Pink family.

Caryophyllaceous. Corolla of plants of the Pink family, consisting of five clawed petals.

Caryopsis. Fruit of the cereals; indehiscent and one-seeded, the pericarp closely adhering to the testa of the seed.

Casa, GIOVANNI DE LA, 1503–1556. Italian poet; Abp. of Benevento. *Galatea.*

Casabianca, LOUIS, 1755–1798. Captain of the French flagship *L'Orient*, which caught fire and blew up at the Battle of the Nile. Chiefly remembered because his ten-year-old son refused to save himself and died with him; versed by Mrs. Hemans.

Casanova de Seingalt, GIOVANNI GIACOMO, 1725–1803. Italian adventurer and political writer. After imprisonment in Venice (1755–57) for an escapade, he visited every European capital and was welcomed in the highest circles, but intrigues and duels kept him a wanderer until 1782, when he became librarian to Count Waldstein in Bohemia and devoted himself to the occult sciences. His *Memoirs*, pub. in Germany before 1825, are well known.

Casas, BARTOLOME DE LAS, 1474–1566. Spanish missionary, noted for devotion to the welfare of the Indians, and protests against their enslavement; priest 1510, Dominican monk 1522, Bp. of Chiapa 1544–47. *Brief Relation*, 1552; tr. 1583.

Casaubon, ISAAC, 1559–1614. Classical prof. in Geneva 1582, and Montpellier 1596; d. in London. He edited many Latin and Greek authors.—His son, MERIC, 1599–1671, prof. at Oxford and prebendary of Canterbury, tr. or ed. *Marcus Aurelius* and other classics.

Casca, PUBLIUS SERVILIUS, d. 42 B.C. Roman tribune, one of Cæsar's assassins.

Cascabel. Projection cast on old smooth-bore guns, in rear of the breach, to facilitate handling them in mounting and dismounting. Its parts are the Knob, Neck, Fillet, and Base.

Cascade Range. Chain of extinct volcanoes in Oregon, Washington, and British Columbia, nearly parallel to the Pacific coast. Its general elevation is 6,000 to 8,000 ft., but numerous volcanic cones rise to heights of 10,000, 12,000, and, in the case of Mt. Rainier, 14,444 ft.

Cascalho. Brazilian river deposits in which diamonds are found.

Cascarilla Bark. *Croton Eluteria.* Small tree of the Spurge family, used as a bitter tonic, native of the Bahamas.

Case. (1) Claim under the constitution, laws, or treaties, cognizable by the judiciary. (2) Papers for which a decision is asked, or an appeal argued. (3) Common-law form of action for injuries done not by direct force, but by fraud, deceit, negligence, and the like.

Case-Hardening. Operation of giving to wrought iron a surface which will resist abrasion and wear as well as hardened steel. The article is heated to redness and immersed in powdered ferro-cyanide of potash, in which it is allowed to cool. Sometimes leather or horn is added to the mixture. The surface of the wrought iron undergoes a cementation and becomes highly carbonized on the surface. It has therefore the toughness to resist deflection which is given by the wrought iron center, and the hardness of steel to resist abrasion on the surface. The process is applied to nuts, engine-guides, pins, etc. Animal and vegetable charcoal are also used.

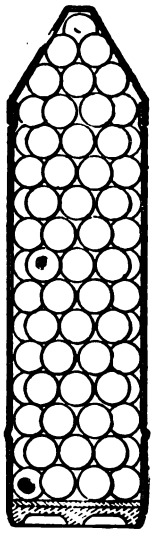
Casein. Albuminoid found in milk of mammals. It contains carbon, hydrogen, oxygen and nitrogen; is insoluble in water, but soluble in acids and alkalies, and is prepared from cow's milk by precipitating the skimmed milk with acetic acid; yellowish powder, sold under the name of lactarine, and used in cotton printing. Vegetable casein or legumin occurs in the seeds of leguminous plants and is similar to casein. It is when separated from milk by the action of the gastric juice or of rennet, and properly manipulated, it constitutes cheese.

Casemate. Originally, in the bastion system of fortification, a loop-holed gallery designed to deliver a fire along the ditch; now any vaulted covered chamber which is proof against direct and vertical shell fire. Guns in casemates deliver their fire through embrasures, and therefore have a narrow field of fire.

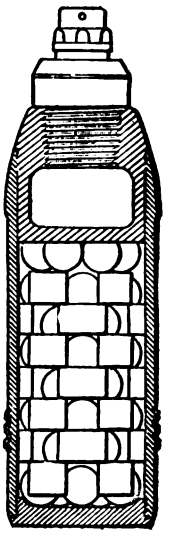
Casemate Haxo. The masonry roof in this casemate slopes to the front from a distance of 10 ft. from the front masonry wall, giving only sufficient height of chamber at the muzzle of the gun to load and work the gun. This arrangement exposes but a relatively small amount of masonry to the fire of the enemy.

Case, MINING. A mining case consists of two stanchions, a capsill and a groundsill, both made of 2″ plank. When these parts are correspondingly notched, tenoned, and put together, they form a case, or "Dutch case." The cases, in a gallery requiring their use, are in juxtaposition.

Case-Shot. Envelope or case containing a collection of small masses which are liberated by the shock of discharge at the muzzle of the gun (Grape or Canister), or at some desired point of the trajectory, by a bursting charge (Shrapnel). Grape and Canister designed to be fired from a smooth-bore gun are now practically obsolete. A stand of Grape consists of three layers of three balls each, held in place by a top and bottom plate connected by a bolt and nut, and each layer separated from the middle one by an iron ring; formerly used with smooth-bore seacoast guns against the masts and rigging of ships, and with siege and field smooth-bores against animate objects at greater distances than musket range. Canister consists of a number of spherical lead bullets hardened with antimony, or of cast iron, contained in a can, whence the name. The can is



Case-Shot.



Shrapnel.

closed by iron top and bottom plates, making it convenient for transportation and loading; used principally with the old pattern smooth-bore guns against animate objects at close range. The canister case is ruptured in the bore of the gun, and the projectiles are scattered at the muzzle, forming a cone of dispersion. With rifled guns, since it is undesirable to impart rifled motion, the case is made stronger and weakened by spiral cuts to insure breaking up in the gun.

Cases in Grammar. The relations of a substantive toward the chief action of the sentence, expressed by case-endings, as in our "possessive," or by prepositions like "of," "from," etc. There were eight cases in the original Indo-European: nominative, genitive, dative, accusative, locative, ablative, instrumental, and the so-called vocative, which, however, is rarely distinguished from the nominative. See INFLECTION.

Cases of Conscience. Cases where the rule of duty in regard to the proposed action is so obscure that a course of inquiry is necessary in order to decide what is right. The difficulty is usually in the form of an apparent conflict of duties.

Cases of Necessity. Violation of ordinary moral rules under the pressure of necessity; *e.g.*, when a man kills another in defense of himself or his family, or when he steals or tells a lie to save his life. Such transgressions are usually treated as venial by positive law and approved even by moralists, provided the necessity be extreme.

Casey, SILAS, U.S.A., 1807–1882. Author of *Infantry Tactics*, 1862.

Casgrain, HENRI RAYMOND, b. 1831. French-Canadian historical writer.

Cash. Ready money, either in coin or other form of currency as distinguished from money on deposit or other assets; used also to distinguish coin from paper money. It is the name of a small copper coin used by the Chinese and called by them *tsien*. It is a round coin exceeding an inch in diameter with a square hole in the middle for the purpose of threading. The characters above and below the hole indicate the reign of the emperor in which the coin was cast. A string of cash may consist of 500 or 1,000, according to locality. The name is also applied to a small Japanese coin, one thousand of which make a yen, or dollar.

Cash-Account. An account of money that is received, paid, or on hand. In banking the term applies to the credit given by a bank to an agreed amount to any individual on receipt of a bond with securities for the immediate payment on demand of the sums actually advanced, with interest. Persons who have such accounts draw on them for whatever sums needed within the prescribed amount and repay such advances when convenient, but generally within short periods. Interest is charged only on the average balance due to the bank.

Cash-Book. Register or account of the receipts and payments of money.

Cashew-Nut. *Anacardium occidentale.* Tree of the Sumach family, native of the West Indies; found throughout the tropics.

Cashew-Nut.

Cashgar. See KASHGAR.

Cashier. Person in charge of cash or money. One who often conducts the principal transactions of a bank; is indeed the real manager. In cities the president is the manager, but the cashier is the most important officer of country banks.

Cashiering. Penalty equivalent to dishonorable dismissal, provided for violation of the Eighth and Fiftieth articles of war. It formerly involved disability to hold public office and to a dishonorable separation from the service. Cashiering was sometimes mitigated to dismissal.

Cashmere. See KASHMIR.

Cashmere Goat. *Capra hircus laniger.* Native of Thibet and Bokhara; famous for its silky hair, 18 in. long, which is imported into Cashmere and made into shawls. The latter were first sent to England 1666 and still command from $500 to $1,500 each. Efforts to naturalize the Cashmere goat in Europe and the U. S. have not been very successful.

Casimir. I., King of Poland 1040–58. II., 1177–94. III., "The Great," 1333–70. He annexed Little and Red Russia, repulsed the Tartars, founded the Univ. of Cracow 1364, and ruled with justice and mercy. IV., 1444–92. He gained w. Prussia 1466, after a long war with the Teutonic Knights, and founded the Polish constitution 1468.

Casimir-Perier, PAUL PIERRE JEAN, b. 1847. Fifth Pres. French Republic, June 24, 1894; resigned Jan. 15, 1895.

Casing Boards. Planks nailed to the buntons to form a partition in a mine shaft.

Caspian Sea. Inland sea of w. Asia, largest on the globe,

Caspian Sea.

bordering on Persia, Russia and Siberia. It receives the waters of the Volga and numerous small streams, but has no outlet; its water is salt, but less so than that of the ocean. Length ab. 700 m., average breadth 200 m., area ab. 170,000 sq. m. Its surface is ab. 97 ft. below that of the Black Sea.

Cass, LEWIS, 1782–1866. Brig.-gen. 1813; Gov. of Mich. 1814–31, with principal charge of Indian affairs; Sec. of War 1831–36; Minister to France 1836–42; U. S. Senator from Mich. 1845–57. Democratic candidate for the presidency 1848 and 1852; Sec. of State 1857–60. He was a defender of slavery but not of secession. He wrote a book on the Indians 1823, and one on France 1840.

Cassagnac, ADOLPHE GRANIER DE, 1806–1880. French Bonapartist politician, journalist and duelist.—His son, PAUL, b. 1843, has followed in his steps.

Cassander, ab. 354–297 B.C. Son of Antipater, regent of Macedonia. He took the title of king 306, and became master of Macedonia and Greece by the battle of Ipsus 301.

Cassander, GEORGE, 1513–1556. Flemish divine, zealous but futile negotiator for reunion between Romanists and Reformed, on a basis of communion in both kinds and the validity of Protestant orders.

Cassandra. Prophetess, daughter of Priam, taken by Agamemnon to Mycenæ, where Clytemnestra killed her.

Cassáno. Town of Italy, 16 m. e. n. e. from Milan. Here Prince Eugene of Savoy was defeated by the French under Vendome Aug. 16, 1705; and the French under Moreau by the Austrians and Russians under Suvaroff April 27, 1799.

Cassation, COURT OF. Supreme court of appeal in France established by the National Assembly 1790. It has three divisions, the Chambres "des Requêtes," "Civilé" and "Criminelle." It has a president, 3 vice-presidents, 49 judges, a public prosecutor and 6 advocates-general, besides inferior officers.

Cassava. Large plants of the genus *Manihot* of the Spurge family, cultivated throughout the West Indies and S. America for their large, starchy roots, from which Tapioca is obtained.

Cassegranian Telescope. Reflecting telescope, having a small, convex mirror near the focus of the large concave mirror, by which the rays of light are reflected through a hole in the center of latter to the eye-piece.

Cassel. Former capital of Hesse, and of Westphalia 1807–13; on the Fulda. Pop.. 1890, 72,641. Its picture gallery contains the finest collection in Germany of works by Rembrandt and Franz Hals, is otherwise rich in other Dutch paintings, and has good examples of Domenichino, Titian, Paul Veronese and, Tintoretto.

Cassell, JOHN, 1817–1865. From a joiner he rose to be a tea-merchant, and later an author and publisher, being the head of the firm of Cassell & Co. *Working Man's Friend,* 1850; *Popular Educator,* 1852; *Family Paper,* 1853.

Cassena Tea. See BLACK DRINK.

Cassia. Genus of plants of the natural family *Leguminosæ,* of wide geographical distribution. Several species yield the drug senna.

Cassia lenitiva.

Cassianus, or JOANNES MASSILIENSIS, or JOANNES EREMITA, ab. 360–ab. 448. Monk in Bethlehem and in Egypt, who went to Constantinople, and thence to Marseilles, where he founded a famous monastery. His writings favor the semi-Pelagian (now Armenian) doctrine, yet he was canonized; his day is July 25.

Cassideous. Helmet-shaped corolla of the Monks'-hood.

Cassini. Family of astronomers, who during 4 generations were directors of the Paris Observatory, 1671-1793. —GIOVANNI DOMENICO, 1625–1712, b. near Nice. JACQUES, 1677–1756. CÆSAR FRANCAIS, 1714–1784. JACQUES DOMENIQUE, COMTE, 1748–1845. The first of this line was the most distinguished. His name is associated with many observations and discoveries of minor importance.

Cassino. Game of cards, with full pack, 2, 3 or 4 players, the last as partners. Four cards are dealt to each and to the table, the latter face up, and subsequently, as the cards in hand are exhausted, four cards to each player. The game is 21 points. The object is to capture as many cards as possible, as follows: "Pairing," taking cards upon the table by a card in hand of same value; "Combining," taking two or more cards upon the table by a card in hand equal in value to the combination; "Building," adding a card in hand to one or more cards on the table, to equal a larger card in hand, to be played in the next round; "Calling," grouping like cards, builds, or combinations, and calling their value, to be captured on next round by a card of like value; "Sweeps," taking all the cards from the table by a card of equal value to table cards. The last cards upon the table, after all cards are dealt and hands played out, belong to the last player. The points are Great Cassino, 10 of diamonds, 2 points; Little Cassino, 2 of spades, 1 pt.; majority of cards, 3 pts.; majority of spades, 1 pt.; each ace, 1 pt.; each sweep, 1 pt., all to be captured. Combinations and builds may be raised by a subsequent player, but calls cannot be raised and can be taken only by card of equal value.

Cassiodorus, MAGNUS AURELIUS, ab. 468–568. Latin author; Minister to Theodoric; from ab. 538 a monk in Calabria. His *Gothic History*, and *Epistles* are of value.

Cassiopeia. The Lady in her Chair. Constellation formed by 5 third-magnitude stars in the form of a W, opposite to the Great Bear and about equally distant with it from the Pole Star.

Cassiterides. Islands where, according to Herodotus, the Carthagenians traded for tin; variously identified with islets near Vigo Bay, the Scilly Islands, and Cornwall.

Cassiterite. SnO_2. Tinstone or tin oxide, the ore from which the tin of commerce is obtained. It occurs mostly in rocks of the older geological formations, or in placer deposits. Found in small quantities in many localities; chief sources of supply are in Australia, the East Indies, Cornwall, and Dakota.

Cassius, CAIUS (LONGINUS), *d.* 42 B.C. Roman tribune 49 B.C.; prætor 44. He formed the conspiracy against Cæsar and won Brutus to the plot; went to Syria as governor, was defeated at Philippi and slain.

Cassock. Long clerical coat usually worn beneath the surplice; black for Anglicans and R. C. priests, purple for R. C. bishops, white for the pope.

Cassowary. *Casuarius.* Bird of Ostrich affinities, living in New Guinea, and other Malay islands, and n. Australia. They have rudimentary wings, live in dense forests, head protected by horny helmet, have blue, red and yellow wattles, three-toed feet, the inner toe with powerful claw, used as weapon, eat large quantities of miscellaneous articles, including indigestible ones; can be tamed; their cry is a loud croak. Eggs, five in number, are laid in Aug. and Sept., in nests on ground, covered in brush. Young are brownish, become blacker, helmet not full-grown until fifth year. See EMU, OSTRICH, RATITÆ.

Castalia. Fountain on Mt. Parnassus, sacred to Apollo and the Muses.

Castalio. See CASTELLIO.

Castanets. Musical instrument originating with the Moors.

Castanheda, FERNAO LOPEZ DE, ab. 1500–1559. Portuguese historian. *Discovery and Conquest of India*, 1551–61.

Castanos, FRANCISCO XAVIER DE, DUKE OF BAILEN, 1756–1852. Spanish general, prominent in the Napoleonic wars, 1807–13. In July 1808 he compelled Dupont to surrender, but was defeated in Nov. by Lannes.

Caste. Originally a Portuguese word indicating the ranks into which Hindoos are divided by the rules of their religion. Brahminism established four castes: Brahmans, or priests; Kshatriyas, or soldiers; Vaisyas, or merchants; and Sudras, or laborers. In modern times, however, the merchant and laborer castes have become subdivided into many others resembling guilds; *e.g.*, milkmen, cobblers, goldsmiths, landlords. In Bengal alone there are many hundreds of these castes, and this class-distinction has extended to other creeds, being found among native Jews, Christians, Parsees, and Mohammedans. This institution of compulsory social exclusiveness was common to the ancient Persians and Egyptians and early Greeks. The penalties of loss of caste have been greatly exaggerated.

Castelar, EMILIO, b. 1832. Spanish statesman, orator, and author; prof. Madrid 1856; ed. *La Democracia* 1864; dictator Sept. 1873–Jan. 1874; from 1876 leader of the moderate Republicans. *Civilization*, 1864; *Republican Movement in Europe*, 1874; *Tragedies of History*, 1883.

Castel Fidardo. In Italy, near Ancona; scene of the papal army's defeat by the Italians under Cialdini, Sept. 18, 1860.

Castellio, or **Castalio,** SEBASTIAN, 1515–1563. Swiss Protestant, driven from Geneva 1544; prof. at Basel 1552. He made Latin and French versions of the Bible 1551–55, and advocated toleration.

Castelnau, FRANCIS, COUNT, 1812–1880. French traveler. *Central and S. America*, 6 v., 1850–51.

Castelnaudary. Town of France, 34 m. s. e. of Toulouse; scene of a royalist victory, Sept. 1, 1632. Pop. ab. 10,000.

Castelvetro, LODOVICO, 1505–1571. Italian critic.

Casteroides. Huge extinct beaver, found in the Pleistocene strata of Ohio and some adjoining States.

Casti, GIAMBATTISTA, 1721–1803. Italian poet. *Novelle Galanti*, 1793; *Animali Parlanti*, 1802.

Castiglione. Town of n. Italy, where Augereau defeated the Austrians under Wurmser, Aug. 5, 1796.

Castiglione, BALDASSARE, COUNT, 1478–1529. Italian author and embassador. *Il Cortegiano*, 1528–61; *Letters*, 1569–71.

Castiglione, CARLO OTTAVIO, COUNT, 1784–1849. Italian antiquarian.

Castile. Originally a small country e. of Leon; united to Navarre, under Sancho III., 1026; and bequeathed to his son Ferdinand; erected into a kingdom 1037; enlarged until it embraced the greater part of Spain; joined to Aragon 1469. The present province occupies the center, and comprises one-quarter of the area of Spain.

Castilho, ANTONIO FELICIANO, 1800–1875. Portuguese poet and translator.

Castilian Mountains. Range in interior of Spain, trending n. e. and s. w.

Castilla, RAMON, 1796–1867. Pres. of Peru 1845–51 and 1855–62. He abolished slavery and Indian tribute.

Castillejo, CHRISTOVAL DE, 1494–1556. Spanish poet and satirist, long resident in Vienna. His works were for a time prohibited by the Inquisition.

Castillejos. In Morocco; scene of Gen. Prim's victory over the Moors, Jan. 1, 1860.

Castillon. Town of s. France; scene of a battle in July, 1453, which ended the English dominion in France except Calais.

Castings. Iron remelted from pigs or scrap and cast in a mold. Repeated remelting and casting improves the quality and strength of cast-iron. Casting was first done ab. 1450, all iron previous to that time being either wrought or steel.

Casting-Vote. That of the presiding officer in case of a tie.

Cast-Iron. The mean weight per cubic foot is 450 lbs., mean tensile strength per sq. inch 20,000 lbs., and mean compressive strength per sq. inch 90,000 lbs. As a material for bridges and other structures subject to shocks cast-iron is now but little used, on account of its brittleness. See IRON, METALLURGY OF.

Castle Garden. At foot of N.Y. City; orig. Castle Clinton; built as a fort by U. S. Government 1807, 300 yards from shore; ceded to the city 1822, and leased as a place of amusement; an opera house 1847; an immigration depot 1855–90; turned over to the park commissioners 1890.

Castlereagh, ROBERT STEWART, VISCOUNT, 1769–1822. Irish statesman and diplomatist. He promoted the Union of 1800; was a minister in several cabinets; was active in guiding the coalition against Napoleon 1812–14; attended the Congresses of Vienna, Paris, and Aix 1814–15–18; became Marquis of Londonderry 1821; and died by his own hand.

Castor — α GEMINORUM. Well-known binary star. Right ascension = 7h. 27m. 31s. Declination 32° 7′ 53″ North. The parallax, determined 1856 by Johnson, is 0″.198; therefore light requires 16½ years to pass from this star to the earth. The period required for the components to perform a revolution about their common center of gravity seems to be nearly 1,000 years.

Castor. Variety of petalite found on Elba; so named by Breithaupt. Silicate of aluminium and lithium.

Castor and Pollux. See DIOSCURI.

Castoridæ. See SCIUROMORPHA.

Castor Oil. Obtained from the seeds of the *Ricinus communis;* used in medicine as a cathartic, and in the arts for various purposes. The seeds contain a poisonous cathartic and irritant principle; children have died from eating them.

Castor Oil Bean. *Ricinus communis.* Large herb of the natural family *Euphorbiaceæ*, native of s. Asia, cultivated for

Castor-Oil Bean.

its seeds; introduced as a weed into tropical America; called Palma Christi.

Castramentation. Art of laying out camps for an army and making such a disposition of troops that the different arms of the service may afford the most efficient mutual support in case of sudden attack.

Castration. Removal of the testicles, a procedure common in animals; adopted in man only in cases of incurable disease of them, or when it is desired, as in the East, to have attendants void of sexual desire, or to cause male voices to assume and preserve the tone of females.

Castrén, MATTHIAS ALEXANDER, 1813–1852. Finnish philologist. Besides his services in connection with the *Kalevala*, 1841, and his researches in matters of Ethnology, he has left valuable studies in the grammar of Finnish and related languages.

Castriota, GEORGE. See SCANDERBEG.

Castro, GUILLEM, 1569–1631. Spanish dramatist. His *Cid* was made the basis of Corneille's tragedy of that title.

Castro, INES DE, d. 355. Mistress or wife of Dom Pedro, infante of Portugal; murdered by order of his father.

Castro, JOAO DE, 1500-1548. Portuguese conqueror of India; viceroy 1547.

Castro, JOSE MARIA, b. 1818. Pres. of Costa Rica 1847–49 and 1866–68.

Casualties. Losses of officers or soldiers by death, desertion, discharge, or resignation; also losses in the fighting strength of an army after a battle, caused by wounds or other causes.

Casuarinaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, including one genus and ab. 25 species, mostly natives of Australia and New Caledonia.

Casuistry. That part of moral science which is engaged with the application of moral rules to difficult cases, to discover what is right in them.

Casus Belli. Event, incident, or cause which gives rise to a declaration of war.

Caswall, EDWARD, 1814–1878. English hymnist. *Lyra Catholica*, 1849; *Hymns and Poems*, 1873. His translations from the Latin are very widely used.

Catacombs. Underground excavations, used as receptacles of the dead, as in Egypt, at Rome, Malta, Naples, and Syracuse. Those of Rome were constructed in the 2d, 3d and 4th centuries, served as places of refuge in times of persecution, abound in Christian symbols and inscriptions, and are thought to contain 6,000,000 bodies. The old quarries under Paris, now used as charnel-houses, bear this name. These underground cemeteries of the early Christians, found at Rome and Naples, continued a mode of burial adopted for the ashes of slaves and freedmen in pagan Rome, but in still humbler fashion. Long narrow passages were excavated in the rock, with cavities on either side just large enough to admit the body, which were closed by slabs after the burial. In the case of distinguished martyrs or prelates these sepulchers were enlarged into small chapels, which were used for religious services during the first three centuries, when public worship was impossible. In some cases chapels were decorated with frescoes, which are the earliest samples of Christian art. Some of these, with many inscriptions and sarcophagi from the same sites, are in the

Catacombs of the Capuchins at Palermo.

Lateran Museum. The most interesting catacombs are those of St. Calixtus, which contain also the graves of St. Cecilia and of the Popes of the 3d century. Their use was gradually abandoned during the 4th century, but it survived as late as the 8th.

Catacorolla. Secondary corolla, sometimes found within the true corolla.

Catagenesis. Creation or evolution of material forms through the action of plastic consciousness, which becomes more limited or fixed in the mode of its manifestation, owing to the gradual running-down of energy.

Catalani, ANGELICA, 1779–1849. Italian soprano, whose career, 1797–1827, was one of the most brilliant in operatic history; her voice had great beauty, power, and flexibility.

Catalepsy. Nervous disease, with sudden and strong contractions of the muscles, which cause the body or portion affected to assume fixed positions; these may continue for a few moments, or days. Consciousness is usually lost, and the pulse and breathing lessened. It is usually chronic, and may be associated with hysteria, epilepsy, or some other nervous disease; or it may occur without any apparent cause.

Catallacta. Marine protozoa, with several stages in development, having a circle of flagella, and forming colonies; *e.g., Magosphæra planula.*

Catallactics. Science of exchanges; term proposed by Whately as a substitute for Political Economy in his treatise on that subject.

Catalonia. N. e. part of Spain; long a Roman province; successively held by Alans, Goths, Moors, and French; united with Aragon 1137.

Catalpa. Genus of large trees of the natural family *Bignoniaceæ*, natives of N. America and Japan. *C. bignonioides* is known as Indian Bean.

Catalpa bignonioides.

Catalysis. Many compounds will not react with each other except in the presence of a third substance, which undergoes no perceptible change during the process. Such reactions are said to be catalytic.

Catamaran. Small raft used in India and, with a sail, in Brazil.

Catamount. Name given to different members of the Lynx family. Also called Cougar, Mountain Lion, Puma, etc.

Catania. Ancient city of Sicily, on e. coast at s. foot of Mt. Etna; founded ab. 710 B. C.; often damaged by eruptions and earthquakes. It exports large amounts of sulphur, grain, and fruits. Pop. ab. 100,000.

Catapetalous. Petals which bear the stamens on their claws or bases.

Cataphyll. Small, scale-like leaves, such as those borne on rootstocks or at the bases of the stems in many herbs.

Catapleiite. $(Na_2,Ca.)(Si, Zr,)_4 O_9+2aq$. Rare Norwegian mineral containing zirconium.

Catapult. See BALLISTA.

Cataract. Opacity of the crystalline lens, commonly due to old age, injury, or diabetes. It is usually progressive, and when complete, the sight in the affected eye is lost. It is relievable only by operation, which consists either in the removal of the lens or in breaking it up so as to allow of its absorption; the latter method is applicable only to those which are fluid or soft.

Cataract. Device used in pumping engines to make the strokes separable by intervals of rest. The rod which operates the admission valve is attached to a plunger or piston, working in a small cylinder. A catch has lifted this rod on the previous stroke and water was drawn into the small cylinder through a check valve. The plunger cannot fall and open steam to the main engine until the water is expelled from below the former; the rapidity with which this may happen is controllable by a cock on an outlet pipe from the small cylinder. When the small cylinder is emptied sufficiently, the main steam valve opens. On some horizontal pumps the cataract cylinder carries a piston, and oil is displaced from one side of the piston to the other at a rate controllable by a cock in the pipe which connects the two ends.

Catarhina. Group SIMIADÆ (q.v.), including the Old World monkeys or apes proper. They may or may not have tails; cheek pouches and natal callosities are often present. The thumb as well as the great toe is opposable to the other digits. The nostrils are close together and look downward. The dental formula is the same as that of man. The canines are quite large in the males. The suture between the præmaxillæ and maxillary bones remains distinct. There is little or no chin, and the superciliary ridges are very prominent. There are two groups, the dog-like apes, CYNOMORPHA (*Cynopitheci*), and the man-like apes, ANTHROPOMORPHA. The first group is again subdivided into two families, the CYNOPITHECIDÆ and the SEMNOPITHECIDÆ (q.v.).

Catarrh. Properly any discharge from a mucous membrane; as commonly used, a chronic inflammation, not easily cured, of the nose and upper part of the throat. Beyond the discomfort and disagreeable features it is of little importance.

Catastrophists. School of geologists who appealed to catastrophe rather than to the slow action of existing causes to account for geological phenomena. See BEAUMONT, ÉLIE DE.

Catbird. *Mimus Carolinensis.* Species of Thrush common in e. U. S., so called from its peculiar note. It is very dark-colored, ab. 9 in. long, and nests in low bushes early in May. It will attack snakes and is very destructive to ripe fruit.

Catbrier. See GREENBRIER.

Catches. Devices to check the fall of parts of the machinery when breaks occur in the hoisting gear of a mine.

Catchfly. Plants of the genera *Silene* and *Lychnis*, natural family *Caryophyllaceæ*, of wide geographical distribution; many species exude a sticky substance in which insects become entangled. Called Campions.

Catchfly (*Lychnis dioica*).

Catching Bargain. Made with an heir, reversioner or expectant, with reference to or on the credit of his expected property. Equity will relieve the expectant from the bargain, unless the other party can show its fairness, as the expectant is presumed to bargain under necessitating distress

Catch-Water Drain. Ditch or drain constructed along the top of an embankment to catch and lead away the water from the higher ground.

Câteau-Cambrésis. Town of n. France where, by treaty of April 3, 1559, France ceded Savoy, Corsica, and several forts to Spain. The French were defeated here by the Austrians April 17 and 26, 1794.

Catechin. $C_{21}H_{20}O_9+5H_2O$. Compound containing a tannin, occurring in several forms of slightly different composition in gambier and cutch; soluble with difficulty in cold water. It constitutes a considerable part of both the dyestuffs named.

Catechism. Instruction, in form of question and answer, as to essentials of doctrine and duty; in use among Christians of every age, and often of great historical importance.

Catechu. Astringent resinous substance, derived from *Acacia catechu* and used for tanning, and in medicine as an

Acacia catechu.

astringent. It contains about 50 per cent of tannin. See CUTCH.

Catechumens. Those receiving preparatory instruction before being admitted to full membership; in the early Church, usually unbaptized converts.

Catechu-Tannic Acid. Of uncertain composition; present in cutch, and obtained by treating cutch with water or by boiling catechu with water; reddish-brown powder with the astringent properties of tannin. It combines with gelatine and vegetable fibers.

Category. Logically, the fundamental conception under which all else is classified; psychologically, the laws or conditions under which man's intellect acts in the formation of knowledge.

Catenary. The curve formed by a perfectly flexible inelastic chain or cord, freely suspended from two points whose distance apart is less than the length of the chain. Its equation is: $y = \frac{a}{2}\left(\epsilon^{\frac{x}{a}}+\epsilon^{-\frac{x}{a}}\right)$.

Caterpillar. See LEPIDOPTERA.

Catesby, MARK, F.R.S., 1679–1749. English naturalist; traveled in N. America and made his own illustrations. *Natural History of Carolina, Florida and the Bahama Islands; Hortus Britanno-Americanus.*

Catfish. See NEMATOGNATHI.

Catgut. *Cracca virginiana.* Perennial herb of the Pea family with very tough roots; native of e. N. America; called Hoary Pea and Goat's-Rue.

Cathari. Mediæval dualists of Slavonic origin, whose higher class claimed especial purity. They were found in Italy 1035, and known in s. France as Albigenses. See DUALISM.

Catharine I., 1684–1727. Wife of Peter the Great 1707; Empress of Russia 1725.

Catharine II., 1729–1796. German princess, m. 1745 to Peter III., who became czar 1761, and was soon deposed and murdered; empress from 1762; noted for ability and vice. She took part in the partition of Poland, 1772 and 1793.

Catharine de' Medici, 1519–1589. Wife of Henry II. of France, and mother of Francis II., Charles IX., and Henry III. She had control of the government from 1560, and was one of the authors of the massacre of St. Bartholomew, 1572.

Catharine of Aragon, 1485–1536. First wife of Henry VIII. of England, 1509; divorced 1533; mother of Queen Mary.

Catharine of Braganza, 1638–1705. Daughter of John IV. of Portugal; m. 1662 to Charles II. of England.

Catharine of Valois, 1401–1437. Daughter of Charles VI. of France; m. 1420 to Henry V. of England, and after his death to Owen Tudor.

Catharine Parr. See PARR.

Catharine, ST., d. 307. (1) Mythical martyr of Alexandria; her day is Nov. 25. (2) Of Sienna, 1347–1380; author of poems and letters; patron of the Dominicans; canonized 1461; her day is April 30. (3) Of Bologna, 1413–1463; day March 9. (4) Of Sweden, d. 1381; day March 22.

Cathartics. Medicines which promote free discharge of the fœces; usually called laxative, purgative, or drastic, according as their action is mild, moderately active, or violent; hydragogue when they cause watery evacuations, and cholagogue when the flow of the bile is increased.

Cathay, KATHAI, or KHITAÏ. Old name of China, still used in central Asia. The Khitán overran the n. provinces ab. 910, and maintained their rule till 1123.

Cat Heads. Timbers on a ship's bows, with sheaves in them by which the anchor is hoisted after it has been hove up by the cable.

Cathedra. Bishop's chair, standing in his church. The papal Cathedra stands in the Ch. of St. John Lateran. A doctrinal decision *ex cathedra* is one rendered with full solemnity and official force.

Cathedral. Church containing the bishop's throne, and usually center of the diocese. Those of England, and many throughout Europe, are of considerable age, great size, and eminent beauty.

Cathelineau, JACQUES, 1759–1793. Leader in the Vendean revolt.

Catherwood, MRS. MARY HARTWELL, b. 1847. American novelist, dealing with early Canadian and Western themes. *Romance of Dollard,* 1890; *Old Kaskaskia,* 1893.

Catheter. Curved tube of metal or rubber, used to draw the urine from the bladder when the patient is unable to void it.

Cathetometer. Instrument by which vertical heights are accurately measured. It consists of a vertical brass rod of triangular cross section, on one side of which is a divided scale. It carries a sliding piece, capable of being clamped in any position, and furnished with a fine adjustment screw. Attached to this slider and at right angles to the bar is a telescope with a pair of fine cross wires in the focus. By focusing the telescope successively on two points at a vertical distance apart, this distance may be read off on the scale. The sliding piece is furnished with a vernier, and the instrument may be read to the one-hundredth of a millimeter.

Cathetometer.

Catholic. Universal; afterward, that which is everywhere the same, as opposed to local heresies and schisms; especially the Church of the Roman Empire. This second meaning obtained soon after 150; the earlier is found in the Ignatian Epistles.

Catholic Apostolic Church. Body taking form under the ministry of EDWARD IRVING (q.v.), 1835, and regarding the twelvefold apostolate as divinely revived, with the primitive supernatural gifts. Its theology and liturgy are a remarkable fusion of Protestantism and Catholicism.

Catholic Emancipation. Act of 1829, removing legal disabilities of Roman Catholics in Great Britain and Ireland. Till 1780 they were prohibited from holding land, from practicing law, from enjoying the rites of their Church, and from marrying Protestants. Some relief was gained by legislation 1791 and earlier. Their remaining disabilities were removed by more recent enactments.

Catholic Epistles. James, I. and II., Peter, I., II., and III., John, and Jude, as of general, not local, destination.

Catholic League. (1) Formed in France 1576 by the Guises; overthrown by Henry IV. See LEAGUE. (2) In s. Germany, 1609, by Maximilian of Bavaria, Leopold of Austria, and many bishops and abbots, in opposition to the Protestant Union of 1608.

Catholic University. At Washington, D. C.; incorporated Nov. 1885; approved by the Pope 1887. It originated in the gift by Miss Mary Caldwell, 1884, of $300,000. In 1891 the Rev. J. McMahon of N. Y. City gave $400,000 toward the department of philosophy. The theological department was opened Nov. 1889; philosophical courses were offered Oct. 1894. Thus far it has received only post-graduate students. It has 8 professors and 2 lecturers. The chancellor is Cardinal Gibbons of Baltimore, the rector Bp. J. J. Keane.

Catilina, LUCIUS SERGIUS, ab. 108–62 B.C. Roman conspirator whose plans were frustrated by Cicero; defeated and slain in Etruria.

Catkin. Elongated flower-cluster, with sessile flowers subtended by scaly bracts, as in Willows and Oaks; also called Ament.

1, Shoot of Birch in spring, bearing large terminal Male (*b*) and Female (*a*) Catkins. 2, Shoot of Birch in autumn with ripe Female Catkin. 3, Female Catkin of Willow.

Catlin. Two-edged knife used in amputations.

Catlin, GEORGE, 1796–1872. American portrait-painter, noted for his researches among the Aborigines. His collection of Indian portraits is in the National Museum at Washington.

Catlinite. Red, compact, easily-worked clay-stone found in s.w. Minnesota; known also as Indian pipe-stone.

Catnip, or CATMINT. *Nepeta cataria.* Plant of the Mint family, native of Europe, introduced into N. America. It has carminative and diaphoretic properties.

Cato, DIONYSIUS. Titular author of Latin *Disticha,* or moral maxims extremely popular in the Middle Ages.

Cato, MARCUS PORCIUS, 234–149 B.C. Roman statesman and writer; prætor 198, consul 195, with command in Spain. As censor, 184, he removed unworthy members from the Senate, and endeavored to resist the luxury which was destroying the morals of Rome. Fragments of his orations remain, with his work on agriculture, *De re rustica.*—His great-grandson and namesake, 95–46 B.C., a Stoic, was tribune 63, prætor 54, and a partisan of Pompey 49. His suicide at Utica was celebrated in Addison's tragedy.

Catodontidæ, or PHYSETERIDÆ. Sperm-Whales. Family of toothed whales (*Denticete cetacea*), having heads one-third the length of the body, containing cavities filled with sperm-oil. The Cachalot of the n. Pacific often grows to a length of 70 ft. They live in schools. The jaws have numerous teeth, but those of the upper do not cut the gums. They feed on Cephalopods (Squids, Devil-Fish). They yield Ambergris from the intestine, supposed to be bile-stones, and used in making perfumes.

Catometopa (GRAPSOIDEA, or QUADRILATERA). See CRABS.

Catoptric Images. Reflected from the cornea and anterior and posterior surfaces of the crystalline lens. The two first are upright, the last inserted.

Catostomidæ. See EVENTOGNATHI.

Catron, JOHN. Chief Justice of Tenn. 1830–36; Justice U. S. Supreme Court from 1837.

Cats. The following species are all of genus *Felis. African:* besides LION, LEOPARD, CHEETAH (q.v.), there are at least five species of small Cats (1), Ancient Egyptian Cat (*F.c aligata*), probable ancestor of domestic breeds except Angora; its color grayish, with dark stripes; (2) Golden-haired Cat (*rutila*); (3)

Gray Cat (*neglecta*); and (4) Yellow Cat (*servalina*), from the West Coast; while (5) the Serval, of whole of Africa, is tawny with black spots, short ringed tail, body three feet long.

American: besides JAGUAR, LYNX, OCELOT, PUMA (q.v.), tropical America has, (6) the Colocolo, Guiana to Chili, a little larger than domestic cat, whitish gray with black marks and slender head; (7) the Eyra, Paraguay to Texas, shaped like a weasel, but as large as a common cat, color uniform chestnut; (8) Geoffroy's Cat, of Paraguay and Chili, whitish brown, with black stripes and numerous spots; (9) the Margay (*tigrina*), Paraguay to Mexico, with tail a foot long, nearly equal to body, color fulvous, with black spots and circles; (10) Ocelot-like Cat (*pardinoides*), of U. S. of Colombia, 1½ ft. long, with dark blotches; (11) Yaguarondi, Paraguay to n. e. Mexico, with tail 2 ft. long, nearly equal to body, color uniform gray to reddish.

Asiatic: besides OUNCE, TIGER, etc. (q.v.), are, (12) Bay Cat (*aurata*), Sumatra, etc., 30 in. besides tail, color bay red; (13) Bornean Bay Cat (*badia*), small cat of bright chestnut color; (14) Bushy-tailed Red-spotted Cat (*euptilura*), of Shanghai, ground color brownish yellow and gray; (15) Chinese Cat, of Canton and Formosa, body ab. 2 ft. long and tail 1 ft.; color yellowish gray with many dark brown spots; (16) Fishing Cat (*viverrina*), of Bengal, body over 30 in., tail 1 ft., color dark gray with brown spots. fierce, catches fish, clams, etc., known to carry off children; (17) Flat-head Cat (*planiceps*), of Sumatra, Borneo, etc.; body 2 ft., tail 7 in., color dark brown with silvery sheen, fur thick; (18) Fontaineir's Spotted Cat (*tristis*), of China, tail 16 in., half length of body, color whitish gray, with brown lines and spots; (19) Indian Wild Cat (*torquata*), body 18 in., tail 1 ft.. more slender, less striped than European Wild Cat; (20) Jerdon's Cat, of Hindostan, 17 in., tail 6 in., has few black spots on gray ground; (21) Jungle Cat (*chaus*), common species, all over India, body over 2 ft., tail a third as long, with black rings, color nearly uniform yellowish gray; (22) Large-eared Cat (*megalotis*), of Indian Archipelago, color yellowish, marbled with black; (23) Leopard Cat or Wagati (*bengalensis*), of Thibet, Burmah, Java, etc., variable, ab. 2 ft. with tail 1 ft., color gray to yellow with several horizontal bars on sides; (24) Manul or Wild Cat, of Mongolia, Siberia, etc., smaller than ordinary cat, with long fur, yellowish gray near skin, white at surface; (25) Marbled Tiger Cat (*marmorata*), Burmah to Borneo, does not exceed 2 ft., has long tail, color fulvous, with dark spots on legs, becoming clouded on body; (26) Ornate Jungle Cat (*ornata*), of n. w. India, smaller than *Chaus* and spotted like a leopard, interbreeds with domestic cats; (27) Persian Cat (*Angora*), larger than domestic, with long silken hair, usually uniformly whitish or yellowish (domesticated); (28) Rusty-spotted Cat (*rubiginosa*), of Ceylon, 18 in. long, tail 10 in., color greenish gray with few streaks and spots longitudinally arranged; (29) Shaw's Cat, of Turkestan, 2 ft. long, tail 7 in., dark gray above, abdomen white with small black spots, also above; (30) Small Cat (*minuta*), of Indian Archipelago, resembles Chinese Cat, but smaller, and tail only 6 in.; (31) Small-eared Cat (*microtis*), of China; (32) Steppe Cat (*caudatus*), of Bokhara, yellowish, with numerous small spots, tail half length of body; (33) Thibet Tiger-Cat (*scripta*), a small cat marked like the Clouded Tiger.

European breeds of domestic: Carthusian (*Maltese*), blue; Manx, of Isle of Man, has three vertebræ in tail, forelegs much shorter than hind legs; another tailless cat in Crimea, Tabby, supposed to be due to cross with Wild Cat whose markings are to some extent reproduced; Tortoise-shell Cat, a breed characterized by sandy color in male, fawn color mottled with black in female, if white also present, is impure; White Cat, with yellow or blue eyes or both, if eyes blue are generally deaf; Black cats without white markings are rare; European Wild Cat, yellowish gray with vertical stripes, and cross bars on legs and tail, is larger than domestic cat, with shorter plumper tail; its period of gestation is 68 days, of common cat is 55 days, yet they interbreed. American Wild Cat is a Lynx.

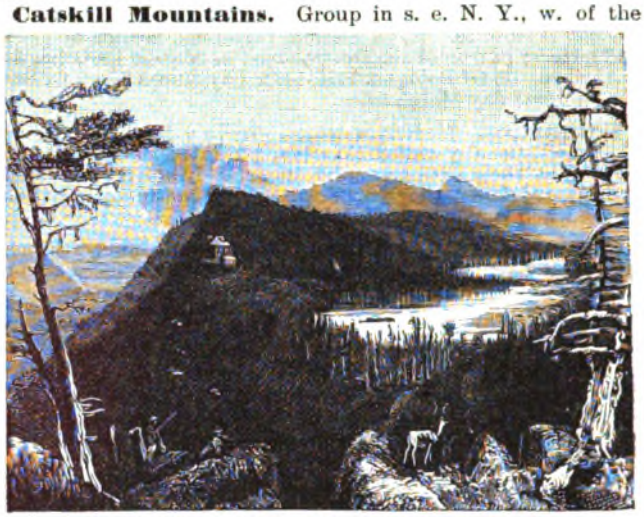
Cats, JACOB, 1577–1660. Dutch poet; grand pensionary of Holland 1636–52, and twice envoy to England. His works were very popular. *Marriage*, 1627.

Cat's-Cradle. Game played by two persons with a string 4 or 5 ft., with the ends tied together. It is held upon the hands of one of the players and removed by the other, assuming different forms. Its original significance is unknown. It is a common game in Japan, *aya ito tori*; in China, *ch'ang tsang*, and in Korea, *sil ti ki*, the names all referring to the pattern in weaving. It is also common among the Malays, the Dyaks of Borneo, and the natives of New Zealand. Among the Pueblo Indians of America, the children fight "Cat's-Cradles," and the knots formed by cords as combined in the various figures have mnemonic significance.

Cat's-Eye. Gem in which a peculiar cleavage structure, or the presence of fine fibers regularly arranged, so act on rays of light, that, when polished, it exhibits a bright, opalescent, central spot or line, from which there is a gradual shading off toward the edges. A cat's-eye effect can be produced in several minerals. The most highly valued are chrysoberyl and quartz.

Catskill. Stratum of sandstone well developed in the Catskill Mts. It is the uppermost of the Devonian strata in N. Y., and corresponds to the Upper Old Red Sandstone of Scotland. See DEVONIAN.

Catskill Mountains. Group in s. e. N. Y., w. of the



The Two Lakes and Mountain House of the Catskills.

Hudson, 3,000 to 4,200 ft. in height. The name is also extended to the plateau which stretches n. nearly to the Mohawk River.

Cat's-Paws. Short gusts of wind, usually having a descending motion, producing small waves on quiet water and severe enough to injure sails and rigging. See WILLIWAYS.

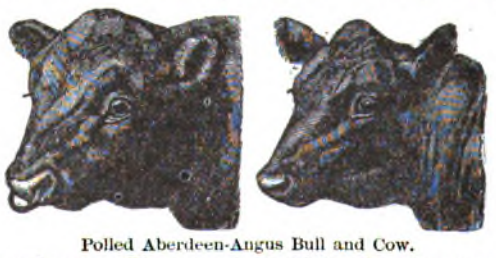
Cat-Tail. Plants of the genus *Typha*, natural family *Typhaceæ*, with long, grass-like leaves and dense spikes of minute flowers, growing in swamps; locally called Reed-mace.

Cattegat. Channel between Denmark and Sweden.

Cattermole, GEORGE, 1800–1868. English artist and illustrator.

Cattle. Originally the term included all domestic animals; but is now limited to the domesticated members of the genus *Bos*. Within the past 200 years intelligent selection and feeding have greatly improved the character of all domestic animals, and none more so than neat cattle. This has given origin to numerous breeds, and since cattle are kept for two main purposes, the dairy and beef, the breeds are of two main types; the former angular and wedge-shaped from before backward, the latter smooth in outline and squarely built. The adult male is a bull, the adult female a cow, the young a calf. The castrated male is a steer, or, when trained to work, an ox; the female, before producing young, is a heifer. In cheese-making districts, calves slaughtered when three days old for the skin and rennet are called deacons. In all parts of the U. S. the cattle industry is one of the most important branches of agriculture. In the e. and central portions most attention is given to the dairy. In the w. and s. w. beef is the almost exclusive object for which cattle are kept; though for the last two decades the dairy industry has rapidly extended westward, until now Wis. and Iowa may be reckoned among the important dairy states. According to the estimates of the Department of Agriculture there were in 1893 in the U. S. 16,424,087 milch cows and 35,954,196 oxen and other cattle, in all 52,378,283. In cows N. Y. led with 1,556,874, followed by Iowa with 1,291,142 and Ill. with 1,093,812. In oxen and other cattle Texas led with 6,462,536, followed by Iowa with 2,704,342 and Kansas with 1,958,735. The following are the more important breeds of cattle raised in the U. S.

ABERDEEN ANGUS.—Black polled Scotch cattle, mainly useful



Polled Aberdeen-Angus Bull and Cow.

as beef producers. They are rivals of the Shorthorn and Hereford in popular favor, but are considered by their partisans

somewhat hardier, and have the great advantage of being hornless. Weight 1,100 to 1,500 lbs., finer beef.

ALDERNEY.—Same as Jersey.

AMERICAN HOLDERNESS.—The only distinct breed of purely American origin. Originated by T. A. Cole of Solsville, N. Y., and said to have descended from a single cow imported from the Holderness district in England in 1835 and her bull-calf, and to have no admixture of other blood. They are of medium size, black in color with a white strip along the back and brisket. They are valued for their dairy qualities, but exist in the pure state in only a few herds. Yield of butter 350 lbs.

ANGLESEA.—Wales, black, 1,100–1,800 lbs., yield 150 lbs. butter, imported U. S. 1885.

AYRSHIRE.—Of Scotch origin, cross of Channel Islands, Dutch and Kylo breeds. They are hardy and give a large amount of milk not specially rich in butter fat. They will thrive on harder fare than any other of the improved breeds found in America. Color red and white or variegated, weight 900–1,100 lbs. Yield of milk 7,000 to 10,000 lbs. annually, rich in casein.

BRITTANY.—French variety, 650–950 lbs., medium amount of rich milk, thrive on poorer pasture than Jerseys.

BROWN SWISS.—Imported from the Simmenthal in Switzerland 1870. They are of large size, and resemble the Jerseys in color, muzzle with band of light hair. They are valued chiefly for the small amount of rich milk they furnish; weight 1,100 to 1,300 lbs.

DEVON.—From the English county of that name. They are of a deep mahogany red, hardy, active, of medium size, 900 to 1,100 lbs., and produce a moderate amount of milk, meat and butter of excellent quality. The steers when trained make the very best light weight oxen. Imported U. S. 1818.

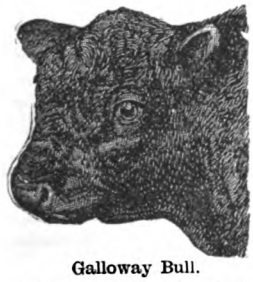
DURHAM.—Same as Shorthorn.

DURHAM, POLLED.—American bred 1889; weight 1,200 to 1,680 lbs.

DUTCH BELTED.—Imported from the s. provinces of Holland. The fore and hind quarters are black, while the middle is encircled by a broad white band. They are good dairy cattle, but in the last twenty years have largely given way to the more popular Jerseys and Frisians.

FRISIAN.—Next to and scarcely less in importance than the Jersey as a dairy breed in the U. S. They are of large size, 1,200 to 1,600 lbs., black and white in color, and yield more milk than any other breed, extreme recorded yield 30,000 lbs. per annum; but it is often lacking in butter-fat, though some cows have given milk scarcely less rich than the Jerseys, extreme recorded yield 1,000 lbs. per year. They are imported from N. Holland and W. Friesland. A few of those first brought came from Holstein in Germany 1861, and the breed bore that name for some time; it is now known as Holstein-Frisian.

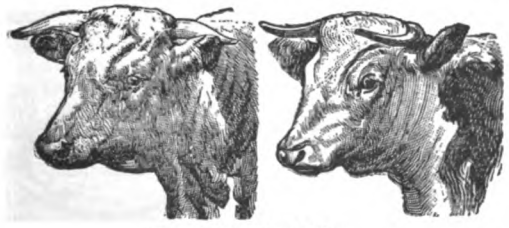
GALLOWAY.—A breed of black polled, Scotch cattle, mainly useful as beef producers. They are distinguished from the Aberdeen Angus by their smaller size, rougher coats, greater hardiness, and less early maturity. Beef produced by them is of the very highest quality when mature and well fattened. Cows, 1,000 to 1,400 lbs.



Galloway Bull.

GUERNSEY.—A dairy breed imported from the Channel Island to U. S. 1850. They much resemble the Jersey, but are larger and coarser in form, same size as Brittany, more inclined to light red and fawn in color, variegated, and make a rather higher-colored butter. They are also thought by some to have hardier and more robust constitutions. They are not found in nearly so large numbers as Jerseys in U. S. They yield their own weight of butter per year from less than half as much milk as Holsteins.

HEREFORD.—An English breed characterized by large size, long slim horns, and dark red color, with white faces, feet, and a more or less distinct line along the neck and belly. They are hardy, of strong constitutions, and by many thought to be better producers of beef than Shorthorns, especially upon grazing lands. Weight 1,200 to 1,600 lbs; bulls, 2,000 lbs. or more. Imported U. S. 1817.



Hereford Bull and Cow.

HOLSTEIN.—Same as Frisian.

JERSEY.—From the island of Jersey in the English Channel, originally from Normandy, and imported U. S. 1830; are characterized by small size, same as Brittany, and peculiar dun-fawn or gray color, shading into black and often diversified with patches of white. Their muzzles are black and encircled with a ring of lighter color. Jerseys are valued for the amount and high color of the butter made from their milk, of which they yield but a moderate quantity. Fair specimens of the breed will make 14 lbs. of butter a week, and individual yields of above 40 lbs. in a week are on record. They have yielded their own weight of butter from less than half as much milk as Holsteins. Jerseys are also found in small numbers on the neighboring island of Alderney, while Guernsey supports a distinct breed. The first Jerseys taken to England were from Alderney; and hence in England and the U. S. they are often called Alderneys.

KERRY.—A diminutive breed found in Ireland, the result of many generations of hard fare and exposure to cold and storms. Black in color, weight 600 to 800 lbs., yield less milk than Jerseys, rich in cream, thrive on poor pasture. They are of no practical value in this country, and only occasionally seen in parks and pleasure-grounds.

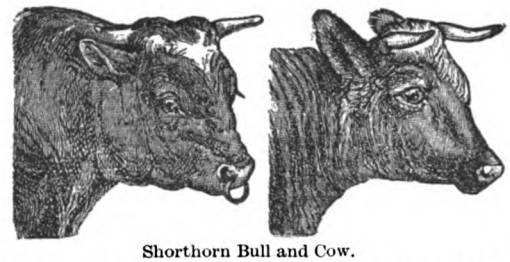
KYLOES.—Of w. Highlands, Scotland; black, long horns, hardy, 700 to 1,000 lbs., beef fine.

LONGHORN.—English, dun-red or roan, white face, horns turned down, few imported U. S. 1872.

PEMBROKE.—(Castle Martins), S. Wales, like Anglesea, and hardy.

RED POLLED.—Chiefly bred in Norfolk and Suffolk. They are solid red in color, hornless, and, while chiefly famous as dairy cattle, are also good beef producers. Weight 1,100 to 1,400 lbs., imported U. S. 1873.

SHORTHORN.—A beef breed, imported by Danes into Durham and Northumberland. They are of large size, grow quickly, and when specially selected to that end give a moderate quantity of fairly rich milk. In color they are red, white, or any admixture of these colors. Dark colors are in much greater favor in this country. Shorthorns have long stood high in popular favor, and are more numerously represented here than any other breed. Their good qualities are largely due to the intelligent efforts of the early breeders. They are often called Durham or Teeswater cattle. Introduced U. S. 1790.



Shorthorn Bull and Cow.

SIMMENTHAL.—Swiss, yellowish-red with white, very large bulls, over 2,000 lbs.

SUSSEX.—Resembling the Devon, but more esteemed in the production of beef and less in the production of dairy products. Wt. 1,100–1,400 lbs.

TEESWATER.—See SHORTHORN.

WEST HIGHLAND.—A breed famous in the English markets for the quality of their beef. Only occasional specimens are brought to this country. They are of small size and covered with an immense coat of shaggy, dun-colored hair.

West Highland Cow.

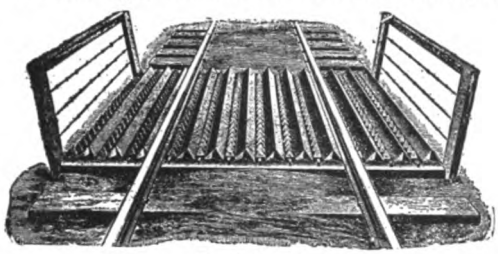
Jersey Cow.

NORMANDY.—France. Brindled and spotted cows, 1,150-1,500 lbs.; bulls sometimes twice as heavy; milk like Jerseys.

BRAHMIN (Zebu).—Color gray, with drooping ears, small horns turned back, and lump over shoulders; were introduced in s. U. S. 1849; are now used to improve the Texan cattle; are hardy and very prepotent. Texas and South American cattle are descended from Spanish stock. Native cattle of U. S. are derived from colonial stock, without care in breeding. Grades are

crosses between natives and high-bred or pure-blooded stock. The dairy conformation consists of small head, narrow through shoulders, broad and deep hind quarters. The beef animal is rectangular in side view and top view. To secure extreme results in dairy performance, we must sacrifice beef qualities. Cows that give large quantities of milk are large and consume much feed, their milk has a low percentage of fat, but the total butter product may equal that produced by the special "butter breeds." Their milk is produced at relatively less cost, their butter at greater cost, than with the latter breeds. A general-purpose cow, combining different points of excellence, is capable of only medium performance in any special direction. The following breeds range intermediate between pure dairy and pure beef breeds: Shorthorn, Longhorn, Devon, Red-Polled, Anglesea, Pembroke, and Normandy.

Cattle-Guard. Device constructed across a railroad track at a road-crossing to prevent cattle from straying upon the track. The old style was a ditch across the track, with side



Cattle-Guard.

fences extending to its ends. Many modern devices are in use, one of which is shown in the figure, the construction being such that animals hesitate to step upon them.

Cattle-Plague (MURRAIN). Name given to various enzöotic, panzöotic and epizöotic diseases of domestic animals, especially of the cow. In a restricted usage the term refers only to the (1) Rinderpest, an Asiatic malady limited to ruminants and periodically imported into Europe. It is accompanied by fever, lasts four or five days, gives rise to diarrhœa and skin eruptions. The mucous membranes become ulcerated and rapid death is almost certain. (2) Anthrax is universal, but is especially prevalent in marshy localities, and is due to the reception of the spores of the *Bacillus anthracis* either by wounds, inoculation by fly-bites (mosquito?), or through drinking stagnant or impure water, or eating fodder that has been previously covered by such water. If introduced into the blood there is a fever speedily fatal, at close of which putrid boils usually appear on sides of tongue, the legs, etc.; or, the local symptoms may be the first to be manifested and the fever follow. In mild cases animal recovers; immunity may be conferred by inoculating with attenuated virus. (3) Pleuro-pneumonia, originally limited to Switzerland, spread over world (U. S. in 1843). Infection through germs received into lungs. The development is slow, lasting for weeks, accompanied by gradually increasing emaciation, etc. Has been stamped out in U. S. by extensive slaughter of infected animals. (4) Foot-and-mouth disease, now stamped out in America.

Catullus, GAIUS VALERIUS. ab. 87–ab. 54 B.C. Roman lyric poet. His 116 extant pieces abound in grace, delicacy and originality.

Caucasian Race. Characterized by fair skin, hair fair to dark, globular skull (orthognathous), high forehead, vertically-placed teeth, narrow nose, and elongated or oval face. To this group belong the Hamitic (Egyptian), Semitic (Jews, Arabs), and Japhetic or Indo-European races (Iranians, Hindoos, Persians, Europeans). See MAN.

Caucasians. Name properly restricted to the inhabitants of Asiatic Georgia, but sometimes used as equivalent of EUR-AFRICANS (q.v.), the white race, one of the five races of man, according to Blumenbach's classification. In the narrow sense, a number of different tribes are included, (1) Georgians, ab. 700,000 souls, are dark complexioned, well fashioned, medium-sized people of independent teachable character. They are socially divided into five castes and are Greek Christians. (2) Tartar tribes, some nomadic, and numbering over a million souls; are Moslems, half savage, but love music and poetry and have a high sense of honor. (3) A number of independent tribes. Caucasians are not a pure race, but a mixture of many; their country lay in the path of the sudo-Germanic emigrations and to this great intermixture the beauty of the Caucasians and other Georgians is due.

Caucasus. Mountain range, trending n.w. and s. e. across the isthmus between the Caspian and Black Seas, forming there the boundary between Europe and Asia. The center of the range is porphyritic trachyte, which comes to the surface along its summit, while stratified rocks lie on its flanks. Its peaks

Caucasian Mountains.

rise to heights of 16,000 to 18,000 ft., the highest being Mt. Elburz, 18,526 ft.

Cauchy, AUGUSTIN LOUIS, 1789–1857. French mathematician. He contributed over 600 memoirs to *Les Comptes Rendus. Algebraic Analysis*, 1821; *Calculus*, 1826; *Theory of Curves*, 1827.

Caucus. Meeting of members of a party to nominate candidates, or to determine on a policy or special measure.

Cauda Galli. Feathery forms of a common fossil (Spirophyton cauda galli), supposed to be a seaweed; exceedingly abundant and covering large surfaces in the Lower Carboniferous rocks.

Cauda Galli Grit. Coarse sandstone near the base of the Devonian in N. Y.. abounding in fossil impressions of the fucoid (?) from which it is named.

Caudata. See URODELA.

Caudex. Slender, cylindrical trunk of palms and tree-ferns; also erect rootstocks.

Caudicle. Central stalk in the anther of an orchard flower, to which the pollen-masses are attached by elastic threads.

Caudine Forks. Mountain passes in Italy, where the Romans were sent under the yoke by the Samnites, 321 B.C.

Cauk, or CAWK. See BARITE.

Caul. Amnion, specially when unbroken and enveloping the head of a child at birth; at one time held to be an assurance against drowning, if carried on the person. Also the omentum, especially that of a lamb.

Caulaincourt, ARMAND AUGUSTIN LOUIS DE, 1772–1827. French general; Duke of Vicenza 1805; envoy to Russia 1807–11; foreign minister 1813–15. *Souvenirs*, 1837–40.

Caulescent. Plants which produce a leaf-bearing stem.

Caulicle. Stem of a germinating plant; part of the embryo of a seed below the cotyledons; synonymous with radicle.

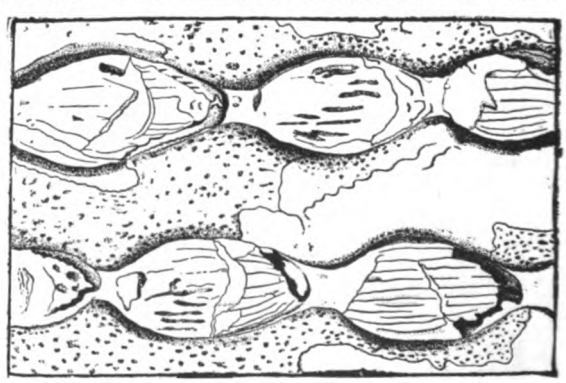
Cauliculus. Inner scroll of a Corinthian capital; the outer scroll, at the angle, is properly a volute.

Cauliflower. Modification of the cabbage; *Brassica oleracea*, having the flowers metamorphosed into a fleshy, nutritious mass; cultivated as a garden vegetable.

Cauline. Structures borne on or belonging to the stem of plants.

Caulking, or CALKING. Process of making the seams of a ship water-tight, by introducing oakum or similar material, which is afterward covered with hot pitch.

Caulopteris. Stems of large tree-ferns found by Newberry in the corniferous limestones of Ohio, and by Hall stand-



Caulopteris Leaves.

ing in situ in the Upper Devonian of Gilboa, N. Y.; also found in the Coal Measures.

Caulotaxis. Manner of arrangement of branches.

Caus, or **Caulx,** SALOMON DE, 1576–1626. French engineer, projector in 1515 of a steam-engine.

Cause. Force, or fact, which gives rise to an event called its effect, the latter not being able to produce itself, but conditioned by something existing before it; this is called an efficient cause. There are three other applications of the term: formal, material, and final causes. The first denotes the essential and universal characteristics of an object, the second the matter of which it is composed, and the last the purpose of an action or thing, the end it seeks or serves.

Cause, LEGAL. That which naturally leads to, and might have been expected to be directly instrumental in producing, a particular result. The law looks only to the direct cause of an event; in other words, it requires a connection between the two, unbroken by a new and independent cause. Great difficulty has been experienced by the courts in applying the doctrine.

Causeries. French journalistic essays, as those of Sainte-Beuve.

Causes Célèbras. (1) Celebrated French state trials, collected by Gayot de Pitival and by Des Essarts. (2) Cases of extraordinary character, as The Impeachment of Pres. Johnson.

Caussin de Perceval, ARMANDE PIERRE, 1795–1871. French Orientalist. *Arabs Before Islamism*, 1847.

Caustic Potash. See POTASSIUM HYDROXIDE.

Caustic Soda. See SODIUM HYDROXIDE.

Caustics. Bodies, such as silver nitrate and the caustic alkalies, which destroy the tissues; used to remove warts, corns, proud flesh, etc.

Caustics. Plane curves of higher order than the second; formed by the intersection of parallel rays of light striking upon a curved surface and reflected or refracted. Reflection gives catacaustics, refraction, diacaustics. The cardioid is the catacaustic of the circle, and is visible when light is reflected from the concave of a cylindrical vessel upon an opaque fluid within.

Cautery. Burning of a surface by a metallic point heated by fire or electricity.

Cautery. Agent, or the result of its action, used to destroy or irritate the tissues; heat and various corrosive chemical bodies are usually employed.

Caution. That form of the virtue of self-control which consists in deliberating whenever and so long as deliberation is judged to be required, even though powerful impulses urge to immediate action.

Cautionary Command. In drill regulations, to prepare the soldier for the intended military evolution, as, Fours Right! followed by the command of execution, March!

Cautionary Signal. First displayed Oct. 1871 by U. S. Signal Service, announcing the occurrence within twelve hours, within a radius of 100 m., of a wind of velocity 25 m. or more per hour. See STORM SIGNAL.

Caution-Money. Money deposited as security. More specifically a sum paid as security by a student when matriculating in an English university.

Cavaignac, LOUIS EUGENE, 1802–1857. French general; gov. of Algeria 1848; pres. Council June–Dec. 1848, after suppressing the insurrection of June.—His son JACQUES MARIE EUGENE GODEFROY, b. 1853, has been active in politics since 1882.

Cavalcanti, GUIDO, ab. 1253–1300. Italian philosopher, lyric poet and friend of Dante.

Cavalcaselle, GIOVANNI BATTISTA, b. 1820. Italian resident in London 1849–58; author, with J. A. Crowe, of *History of Painting in Italy*, 1864–71; *Early Flemish Painters*, *Titian*, 1876, and *Raphael*, 1883.

Cavalier. Interior defensive work constructed in the bastion or on the curtain to obtain a plunging fire on the besieger's trenches when the latter reach the glacis.

Cavalier, JEAN, 1680–1740. Peasant of Lower Languedoc, who rose to the highest rank as commander and tactician; led the CAMISARDS (q.v.), and maintained a successful conflict against the disciplined French armies; unable to carry out a treaty with Villars, he entered the English service; commanded a regiment of Camisards against the French in Spain 1705; became major-general in British army, and governor of Jersey.

Cavalieri, BONAVENTURA, 1598–1647. Prof. of mathematics at Bologna. He invented the "principle of indivisibles," containing the germ of the integral calculus. *Geometry of Indivisibles*, 1635; *Exercitationes Geometricæ Sex*, 1647.

Cavalieri, EMILIO DEL, ab. 1550–ab. 1600. Roman nobleman; active in the reform of music which led to the invention of the opera.

Cavaliers. Orig. horsemen, knights; then especially the Loyalists adhering to Charles I. of England in his contest with the Long Parliament.

Cavalier-Trench. Raised parapet, 20 to 30 yards long, with crest perpendicular to that of the covered way; designed to give besiegers such command over the covered way as to obtain a plunging fire and to make it untenable. Owing to their near location to the the enemy's works, they are difficult to construct and easily destroyed.

Cavalry. All troops intended to fight on horseback, whether hussars, cuirassiers, lancers, dragoons, or otherwise. The present tendency is to convert all cavalry into dragoons; hence such troops ought to be armed with a carbine or rifle. The value of cavalry arises from the rapidity of its movements. When fighting mounted, the shock of its charge is of chief importance; in scouting or reconnoissance, it acts as the eyes of the army and keeps it informed of the enemy's movements. Its arms are the saber or lance, the pistol and carbine. Its tactics are based on these principles: to attack at speed; to strike at the enemy's flank; to have a reserve, and to use the reserve and supports on the enemy's flank as it comes successively into action; to charge so that the requisite depth on contact shall be maintained; never to attack over unknown ground, nor receive an attack at a halt, nor to charge without support.

There are 10 regiments of cavalry in the present peace establishment of the U. S. Army, 8 of white troops and 2 of colored. Each regiment consists of 43 commissioned officers and 605 enlisted men. But 10 troops in each regiment are fully organized, the two remaining being skeletonized.

Cavanilles, ANTONIO JOSE, 1745–1804. Prof. of botany at Madrid.

Cavanilles y Centi, ANTONIO, 1805–1864. Spanish historian.

Cavatina. Operatic air in one part.

Cavazza, MRS. ELIZABETH. American writer, chiefly on Italian subjects. *Don Finimondone*, etc., 1892. She became Mrs. Pullen 1894.

Cave. Rock-hollow of natural formation. The agencies by which caves occur are river- and sea-erosion during gradual upheaval, landslips, lava-flows and the action of subterranean water. The latter produces the most extensive caves, such as the series at Luray, Va., and the Mammoth Cave, Ky. Fingal's Cave, Scotland, is a noted example of sea-action, and the famous Fossa della Palomba of Etna is a lava-cavity, others occurring in Iceland, the Azores, Canary and Hawaiian Islands. For artificial caves see BAMIAN, ELEPHANTA, etc.

Cave Dwellers (TROGLODYTES). Prehistoric races using caves as natural habitations. Relics of their weapons, wares, carvings, bones of animals used for food, and of contemporary wild species as well as their own skeletons are found in successive strata of debris, overlaid with soil and calcareous deposits in the caves of Europe. Evidence of at least two great epochs: (1) Paleolithic of Pleistocene period at close of Glacial Period, during the Drift Period; (2) Neolithic, during which bronze and iron tools were successively introduced, and which merges into the Historic Period. The former period is characterized by presence of animals, now extinct in Europe, as mammoth, rhinoceros, hippopotamus, cave-bear, saber-toothed tiger, Irish elk, musk sheep, etc. North Europe was lower than now, South Europe was higher, so that land connected Europe with Africa across Messina, and Sahara was ocean. The inhabitants of this period resembled the Eskimos, who are their probable descendants. They had no domestic animals, no pottery, no form of sepulture, but dress of skins, harpoons of bone or flint. The reindeer and Arctic cetaceans, walrus, etc., were abundant in France. In the later or newer Stone Age the Iberians, now represented by the Basques, pressed the Eskimo northward. They were short, from 4 ft. 10 in. to 5 ft. 6 in. high, with oval orthognathic faces. They had pottery, domestic animals, polished flints, and buried their dead in contracted posture. They were pushed to the mountains by the Celts, of high cheek bones, prognathic, brachycephalic and tall in stature, the builders of cairns and megalithic monuments. They, in turn, were pushed west by Teutons.

Cave, EDWARD, 1691–1754. Founder of the *Gentleman's Mag.*, 1731.

Cave, WILLIAM, D.D., 1637–1713. Anglican divine. *Primitive Christianity*, 1672; *Fathers of the 4th Century*, 1682; *Historia Literaria*, 1688–98.

Caveat. Formal warning by a party interested against a specified proceeding, such as probating a will, issuing a land patent, or a patent for an invention.

Caveat Emptor. "Let the buyer beware." In a sale of a specific chattle, when the seller neither defrauds or warrants, the buyer must be his own judge of quality. Such is the law of England and of all the U. S. except S. C. and La.

Cavendish, HENRY, 1731–1810. English chemist, who discovered hydrogen 1766, and the composition of water 1784. He proved the constant composition of the atmosphere, and showed that nitric acid could be made from oxygen, nitrogen, and water. Each of these discoveries aided to overthrow the phlogiston theory. *Electrical Researches*, pub. 1879.

Cavendish, SIR THOMAS, 1555–1592. English seaman, who visited Va. 1585, wrought destruction in the Spanish Main 1586, and circumnavigated the globe 1586–88; knighted 1588. Another voyage, 1591, was cut short by mutiny.

Caviare. Salted sturgeon's roe, prepared in Russia and the U. S.

Cavicornia. Hollow-horned Ruminants, comprising the Antelopes, Sheep, and Oxen. All are characterized by having persistent hollow and unbranched horns borne on a process from the frontal bone, generally in both sexes. Gregarious and most polygamous. The upper jaw has grinding teeth only. There are three families, *Antilopidæ*, *Ovidæ*, and *Bovidæ*.

Cavies. See HISTRICOMORPHA. Rodents, of which the domestic Guinea-pig is typical. There are many species, all are S. American and, except the Chinchilla, most are large like a hare or a pig. The Capybara is the Water Cavy, is 20 in. high and 4. ft long and resembles a pig except for its snout. Abundant along and in Brazilian rivers. Tke Guinea-pig has rudimentary clavicles and tail, four toes in front and three behind, the claws hoof-like. The young shed their milk-teeth before birth. The Patagonian Cavy resembles a large hare, lives in burrows and is shy.

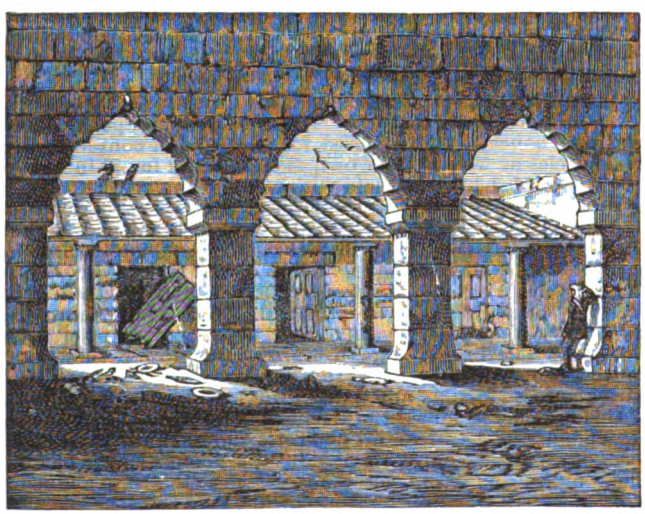
Cavin. Natural depression or covered way by which troops may approach a defended position unobserved.

Cavour, CAMILLO BENSO, COUNT DI, 1810–1861. Premier of Sardinia 1852–59, and of Italy 1861. His farsighted statesmanship led to the surrender of Lombardy by Austria 1859, and to the unification of Italy, excepting Venetia and the Papal States, which were added 1870.

Cavy. See HISTRICOMORPHA.

Cawein, MADISON, b. 1865. Kentucky poet.

Cawnpore, or CAWNPUR. City of India, at junction of Jumna with Ganges; of small importance till made a military station by the Nawab of Oude 1777. It became British property 1801. Here Nana Sahib massacred 1,000 English captives during mutiny of 1857. Pop., 1891, including cantonment, 188,172.



The "Slaughter-House," Cawnpore, where the Massacre took place.

Caxton, WILLIAM, ab. 1422–ab. 1492. Introducer of printing into England 1474, and translator of most of the books he printed.

Cayambe. Peak of the Andes, in Equador; ht. 19,530 ft.

Cayenne. French penal colony and capital of French Guiana, settled 1604. During the 17th cent. it was captured by and recaptured from the English and Dutch. Cayenne pepper (*Capsicum beccatum*) is produced here.

Cayley, ARTHUR, b. 1821. Prof. Cambridge 1863; with Sylvester, a leader in the progress of modern algebra. *Linear Transformations: Elliptic Functions*, 1876.

Caylus, ANNE CLAUDE PHILIPPE, COMTE DE TURIERES, 1692–1765. French antiquarian.

Cayman. S. American alligator.

Cayuse. See HORSE.

Cazal, MANUEL-AYRES DE, 1754–ab. 1822. Historian and geographer of Brazil 1817.

Cazin, JEAN CHARLES, b. ab. 1840. French landscape and figure painter.

Cazotte, JACQUES, 1729–1792. French poet.

Ceadwalla. King of Wessex, England, 685–88. He subjugated Sussex and the Isle of Wight.

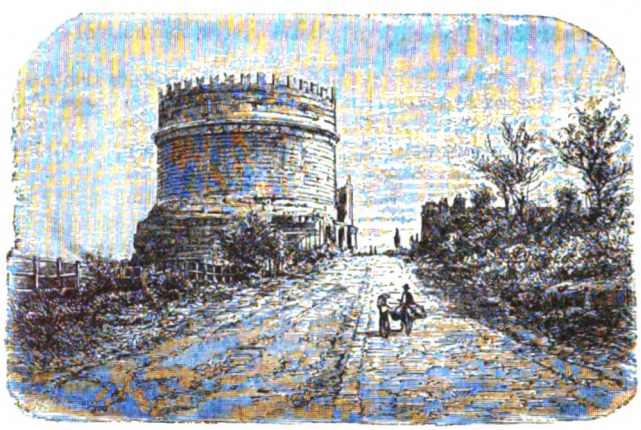
Cebes, TABLE OF. Greek dialogue, ab. 100; long popular.

Cebidæ. See PLATYRHINI.

Cecidomyia. See GALLICOLÆ.

Cecil, RICHARD, 1748–1810. Anglican divine, leader of the Evangelical party. *Works*, 4 v., 1811.

Cecilia Metella (CÆCILIA METELLA). Wife of the son of the triumvir Crassus. Her famous tomb is on the Appian Way near Rome. The frieze of this building contains chaplets of flowers and skulls of oxen, and is called Capo di Bove.



Tomb of Cecilia Metella.

Cecilia, ST. Patron of music; supposed Roman martyr ab. 210. Her day is Nov. 22.

Cecomorphæ. See LONGIPENNES.

Cecropia. Acropolis of Athens.

Cecrops. Mythical founder of Athens and first king of Attica.

Cedar. Coniferous trees. The Cedar of Lebanon is *Cedrus libani;* the Indian Cedar, *C. deodar;* the Red Cedar of e. N. America, *Juniperus virginiana*, called also Savin; the White Cedar of the n. U. S., *Thuja occidentalis;* that of N. J. and the South, *Chamæcyparis thyoides*.

Cedar Apples. Excrescences borne on trees of the Red Cedar, caused by Fungi; of the genus *Gymnosporangium*.

Cedar Creek. In Shenandoah co., Va. Here the Union forces under Sheridan, after falling back, rallied and repelled an attack by Confederates under Early, Oct. 19, 1864.

Cedar, JAMAICA. *Cedrela odorata.* Tree of the Mahogany family, native of tropical America. The New South Wales Cedar is *Cedrela australis;* the Bengal Cedar, *C. toona;* the Brazilian, *C. brasiliensis.* The wood of these trees is adapted to cabinet-work.

Cedar, JAPAN. *Cryptomeria japonica.* Tree of the natural family *Coniferæ*, native of Japan, planted for ornament in Europe and America.

Cedar Mountain. Culpeper co., Va.; scene of a Federal defeat Aug. 9, 1862.

Cedar Rapids. City of Linn co., Iowa, on Cedar R. Pop., 1890, 18,020.

Cedar River. Branch of the Iowa R., in Iowa. Length ab. 300 m., drainage area 7,416 sq. miles.

Cedar, WHITE. *Chamæcyparis thyoides.* Large evergreen tree of the Pine family, growing in swamps in the e. U. S.; also the American Arbor-Vitæ, *Thuja occidentalis*, of the same family, native of n. N. America.

Cedar Wood, GUIANA. *Icica altissima.* Large tree of the natural family *Burseraceæ*, native of Guiana, yielding an odorous wood.

Cedron. *Simaba cedron.* Small tree of the natural family *Simaburaceæ*, native of the Isthmus of Panama and adjacent territory. The seeds are very bitter, and are used as a tonic.

Ceiling. Inner roof of a building, or covering of a room, concealing the rafters of the roof or the beams of the floor above; now commonly a coating of plaster, but anciently

composed of slabs or arches of stone, or beams and panels of timber; these methods are still employed in buildings of exceptional costliness.

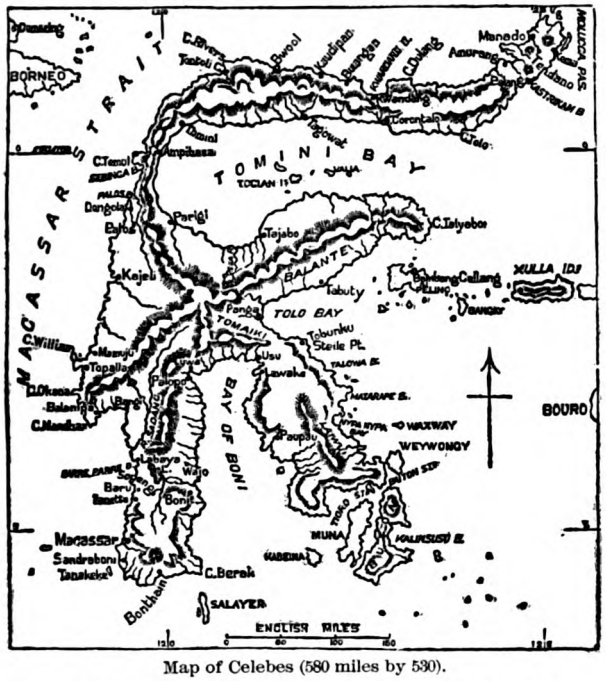
Ceillier, Dom Remy, 1688–1761. French Benedictine, prior of Flavigny. *History of Sacred Authors*, 23 vols., 1729–63.

Celakovski, Franz Ladislaus, 1799–1852. Bohemian poet.

Celandine. *Chelidonium majus.* Plant of the Poppy family, native of Europe, introduced as a weed in N. America.

Celastraceæ. Natural family of flowering plants of the class *Angiospermæ*, and sub-class *Dicotyledones*, comprising 39 genera and ab. 300 species, distributed through all parts of the earth; the Staff-tree family.

Celebes. Island of irregular shape, between the Indian Ocean and the Pacific, e. of Borneo. Its surface is mountain-



Map of Celebes (580 miles by 530).

ous, but its soil fertile. Area ab. 70,000 sq. m. Pop. ab. 800,000.

Celebes Sea. Arm of the Pacific, between Borneo, Celebes, and the Philippine Isles.

Celeomorphæ. See Picidæ.

Celery. *Apium graveolens.* Herb of the Carrot family, native of Europe and of the s. hemisphere, poisonous in the wild state, but edible when cultivated.

Céleste, Mme., 1814–1882. French dancer, well known in the U. S. from 1827, and in England from 1830.

Celestina. Spanish dramatic romance, produced ab. 1480. Its first act was by Rodriga Cota; twenty more were by Fernando de Rojas.

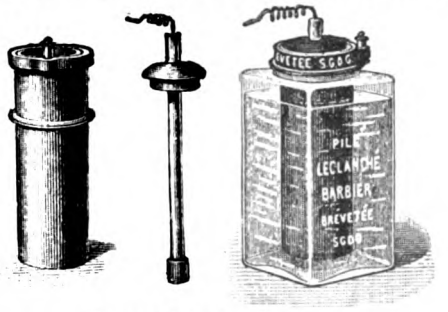
Celestine. I., Pope, 422–432. II., Guido di Castello, 1143–44. III., Jacinto Orsini, 1191–98. IV., Godfredo Castiglione, 1241. V., Pietro di Murrone, 1215–1296, founder of the Celestine Order of monks 1254; Pope 1294; abdicated, and was imprisoned by his successor, Boniface VIII.; canonized 1313.

Celestines. Monastic Order founded 1254 by Pietro de Murrone, afterward Pope Celestine V. Though now very much reduced, the Order had in the 16th century 200 religious houses in Italy, France, Germany, and the Low Countries.

Celestite, or Celestine. $SrSO_4$. Natural strontium sulphate, occurring in beautiful crystalline masses associated with native sulphur; also found with limestone and sandstone.

Celibacy of the Clergy. Obligation of R. C. bishops, presbyters, and deacons, to live unmarried. The Eastern secular priests, even when subject to Rome, are only required not to marry after ordination.

Cell, Voltaic. One of the units composing a voltaic battery. The earliest form was Volta's crown of cups, each of which contained acidulated water in which were immersed two plates, one of copper and one of zinc. If the plates of successive cells be joined by a wire, a current of electricity flows through the wire from the copper to the zinc. The objection to cells of this sort is their rapid deterioration, due to polarization or the collecting of hydrogen bubbles on the copper plate. Cells devised by Daniell, Grove, Bunsen, and others, known as two-fluid or non-polarizing cells, are much more constant in their



Improved Leclanche Cell.

action. The Leclanche cell has manganese dioxide in the inner porous cell and ammonium chloride in the outer cell.

Cell. Originally a small, inclosed space first applied to the component units making up the tissues of plants which, having rigid cellulose walls, resemble the cells of the honeycomb; but now the protoplasmic contents of such cells are known to be primary and to secrete the wall as a secondary formation, so the term refers to this living unit which in the *Protozoa* lives as a separate and complete animal. Lately we have obtained evidence that the protoplasm of cells is itself of secondary importance to the chromatin, which composes most of the cell nucleus.—In Botany, cavity of an anther-sac or that of an ovary.

Cell-Division. Reproduction of cells by simple constriction into two halves. It is preceded by nuclear division, which may be direct or indirect. See Karyokinesis.

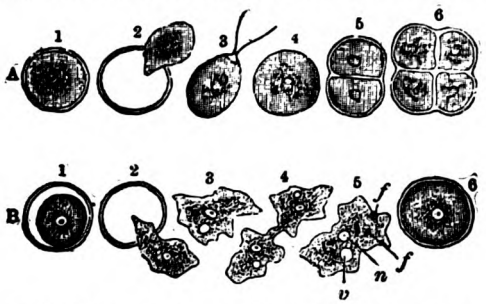
Celleporina. See Chilostomata.

Cellini, Benvenuto, 1500–1572. Italian goldsmith and sculptor. He connects the generation of Michelangelo with the taste and tendencies of later times, being the last to represent the power and simplicity of the early 16th century, and the first to show the tendency to elongated and *raffiné* forms which ruled the French and Italian art after 1550. The *Perseus* in Florence is his leading work. In the Louvre is his *Nymph of Fontainebleau.* His life-size silver statues made for Francis I. have disappeared. As goldsmith and medalist he executed many beautiful works. His Autobiography is our best original document for his times; it was tr. into German by Goethe, and into English by Roscoe 1822, and Symonds 1887.

Cell Theory. Established by Schleiden and Schwann 1839–41. Briefly stated, it stands at present thus: the cell is a unit which can reproduce itself by budding, self-division, or spores. These remain separate individuals in the *Protozoa*, but in the *Metazoa* they remain united and thus present the phenomena of the segmentation of the egg and the embryonic development or ontogeny. By the operation of the principles of differentiation and division of labor the cells combine to form higher units or individuals, whose bodies are complexly organized of parts, mechanisms, tissues, and organs. There is good evidence that the cell itself derives its unity from a similar synthesis of gemmule units.

Cellular Biology. This science was born ab. 1840, when the researches of Schleiden in Vegetable Histology and of Schwann in Animal Histology resulted in the conception of the colonial nature of the bodies of the higher plants and animals. This means that the organized bodies are associations of cell-units. Opinions differ as to the sort of relationship or physiological economy that exists between the tissues of plants and animals, but the analogy between the organizations of mankind into societies, cities, nations, etc., and the "cell-state" that constitutes an individual, is at least a striking if not a perfect correspondence. Political economy can gain many suggestions from the analogy. But the cell itself is also an organization of units. There are thus two sides to the science of the cell: one looks inward, and involves karyokinetic investigations; the other looks outward, and includes all histology, both of adults and of developing embryos, both normal and pathological. When the term Cellular Biology is used in a restricted sense, the former aspect of the science is denoted. At first only the cell-wall was denoted by the term cell, but it was soon learned that this was a product formed by the activity of the inclosed protoplasm. Then came a period of controversy as to whether the presence of a nucleus was necessary or not, and before the technique of staining had made any real progress it seemed correct to believe in the existence of non-nucleated cells. Haeckel formulated a principle to the effect that a nucleated cell is a higher evolution, and that the eggs of all organisms after fertilization return to the non-nucleated condition before starting on the upward road of development,

in which ontogeny repeats the phylogeny. Advances in microscopic technique ab. 1880 rapidly led to several important discoveries: 1st, that the nucleus is a complicated structure and undergoes remarkable changes during cell division (see KARYOKINESIS); 2d, that the nucleus never disappears from eggs; 3d, that unicellular organisms, that seemed to lack a nucleus, possess the chromatin granules, of which nuclei are constituted, in a diffused or scattered form; 4th, that protoplasm and deuteroplasm are made by transformation of chromatin granules, so that the nucleus makes the protoplasm, just as the latter (?) makes the cell-wall; 5th, it was shown by researches on the phenomena of fertilization that the nucleus, and it alone, carries all the hereditary traits of an organism. This was ably discussed by Kölliker in 1885. Chromatin was thus seen to be identical with the idioplasm of Nägeli. Further researches have added materially to our knowledge of the structure of cells, leading to the conclusion that there are different sorts of chromatin, and that the cell is a complicated structure. Thus the old notion of the cell as a "bit of structureless jelly called protoplasm," or a definite "chemical substance endowed with the properties of life," is thoroughly demolished. It is plain that the physiological activities of an organism are due to the activities and relations of its cells; hence all biology and medicine rests ultimately on the knowledge afforded by investigations in the science of Cellular Biology.



A, Life-history of unicellular plant (*Protococcus*): 1, encysted; 2, quitting its cell; 3, ciliated; 4, quiescent; 5 and 6, dividing.
B, Life-history of Amœba: 1, encysted; 2, escaping; 3, free; 4, dividing; 5, free half with vacuole *v*, nucleus *n*, and food-particles *f*; 6, encysting anew. 4 and 5 may also represent the union of two Amœba (conjugation).

Cellularina. See CHILOSTOMATA.

Cellulitis. Diffused inflammation of the connective tissue, especially of that in the pelvis and around the uterus. It is usually a more or less serious condition, and is apt to be followed by suppuration.

Celluloid. Mixture of NITROCELLULOSE (q.v.) and camphor; readily inflammable, but not explosive; used for making a great variety of articles as a substitute for amber, guttapercha, turtle shell, ivory, etc.

Cellulose. ($C_6H_{10}O_5$). Carbohydrate of the Starch family, constituting the membrane of plant cells. Cotton is nearly pure cellulose. It is made by the action of alkali or a bisulphite on wood; white amorphous powder, changed by dilute acids into dextrose and dextrine. Nitric acid converts it into guncotton. It is soluble in SCHWEITZER'S REAGENT (q.v.). See also FIBER and NITROCELLULOSE.

Celo. Name proposed by Lock for the unit of acceleration. Equal to the acceleration of a point which, moving with uniformly increasing velocity, has its velocity increased by one foot per second.

Celsius, ANDERS, 1701–1744. Swedish astronomer; inventor of the centigrade thermometer 1742, the zero being the freezing point and 100° being the boiling point of water, at 76 mm. pressure.

Celsus. Greek philosopher of 2d century, noted as an opponent of Christianity. His book is known only through Origen's citations and comments.

Celsus, AULUS CORNELIUS. Latin author of 1st century, whose surviving work, *De Medicina*, holds an important place in medical history.

Celtiberi. Race of ancient Spain, probably of mixed Iberian and Celtic stock; subdued by the Romans 72.

Celtic Art. Best known before the Christian period from the decoration of metals—gold, silver, and especially bronze. The objects known are mainly armor, horse-trappings, and vessels. The patterns are similar to those of other prehistoric art of the Bronze Age, mainly concentric rings and spirals, probably derived, with the arts of metal, from the s. e. Relics of this art are especially numerous in Ireland and Scotland. In the Christian period interlacing spirals and strap-work are developed into very complicated patterns, and in the Missals and Scripture MSS. connected with grotesque animal forms. Bells, crosiers, shrines, and brooches were also beautifully decorated

The Bell Shrine of Kilmichael-Glassary.

with filigree and enamel. The stone crosses of Ireland and Scotland are also fine examples of this art, which flourished down to the 10th and 11th centuries. The Books of Kells in Dublin and Lindisfarne Gospels in the British Museum are famed examples.

Celtic Church. Little known in its early history; it lasted, in Britain and Ireland, distinct from the Roman discipline, till ab. 1150. Its Gaelic branch had a large share in evangelizing England and Germany.

Celtic Languages. Group belonging to the Indo-European family, once spread over n. Italy, France (Gaul), Spain, Great Britain, and other countries (see GALATEA), but now practically limited to the Scottish Highlands and parts of Ireland, Wales, and Brittany, and with no living vigor except in Wales. Manx (spoken in the Isle of Man), the speech of the Highlands and of certain islands on the n. w. coast of Great Britain, and Irish, are three dialects which belong to one group, often called Gaelic. Welsh and Armoric (in the French Basse-Bretagne), belong to another group, often called Britannic. Cornish, now defunct, also belonged to this group. Only a few inscriptions remain of the continental Celtic; but the literature of the two branches named above is fairly extensive and important.

Celtomania. Exaggerated opinion held by certain philologists regarding the age, value, and extent of the old Celtic dialects.

Celts. See GAULS.

Celts. Obsolescent name for bronze and stone ax-heads found among the remains of prehistoric man in Europe. Fastened into horn, bone, or wood handles, they were used as implements of war, hunting, and rude carpentry. Some, of ornamental stone, are beautifully formed and polished.

Cement. Lower portions of beds of auriferous gravel (as in Cal.) which, by the action of ferruginous waters, have become consolidated into a conglomerate.

Cement. Any substance that holds together the surfaces of two bodies without mechanical rivets. Ordinary mortar, for stone or brick construction, is composed of slaked lime (calcium hydroxide), and silicious sand, in proportion one of the former to three of the latter by volume, mixed with water. This hardens, forming a silicate of calcium. Hydraulic and Portland cements have the property of hardening under water. It is made by calcining hydraulic limestones, which contain clay or silicate of aluminium, or from artificial mixtures of lime and silicate of aluminium, up to 20 per cent of the latter. Portland cements are nearly all artificial. Hydraulic mortar is a mixture of one part of cement to three of silicious sand by volume, mixed with water. In setting double silicates of aluminium and calcium are formed, which at the end of two years, with Portland cements, have a crushing strength up to 2,000 lbs. per sq. in., the slower setting cements being the best. Rosendale cement, which contains lime, magnesia and clay, when mixed with three parts sand, has at the end of two years up to 700 lbs. per sq. in. In 1892 there were produced in U. S. 8,132,593 bbls. hydraulic cement and 525,360 bbls. Portland cement, and there were imported 3,254,184 bbls. Portland cement, of 300 lbs. Iron cement for joining iron pipes is composed of cast iron filings 16, sulphur 1, and ammonium chloride 2. Marine glue is a mixture of caoutchouc and shell-lac, and Gelatin cement is composed of glue and acetic acid. Casein cement is

a mixture of boiled cheese and quicklime, and is used warm. White and red lead with boiled linseed oil forms a good cement for glass with metals. For use in furnaces fire clay cements, high in silica, are used, and for joining marble plaster of Paris is used. Diamond cement consists of a mixture of gum-mastic, ammoniacum and isinglass in alcohol.

Cement Rock. See HYDRAULIC LIMESTONE.

Cement Tests. Cement is tested for quickness of setting by noting the time required before it can bear a wire $\frac{1}{24}$th in. in diameter when loaded with $\frac{1}{4}$ lb. A small thin cake put under water after setting should not crack or become discolored. A briquette having a cross-section of 1 sq. in. is also tested in a tensile machine; natural or Rosendale cement, after 24 hours' immersion in water, should stand from 40 to 80 lbs. per sq. inch, while Portland cements should stand from 100 to 140. The strength of hydraulic cements and mortars increases with age.

Cemetery. Burying-ground as distinct from churchyard. Those ancient nations, such as the Jews, who buried their dead, had cemeteries for the poor, the stranger, and the criminal beyond the city walls. The early Christians used theirs for worship until persecution drove them to the CATACOMBS (q.v.). Abp. Ubaldo carried to Pisa, in the 13th century, 53 shiploads of the earth of Calvary to form the Campo Santo (Holy Field), which hence became the generic term for an Italian cemetery. It is usually surrounded by arcades enriched with sculptures and paintings. The sylvan cemeteries of the Turks, with a cypress at the head of every grave, are a noticeable feature of the landscape in the Levant. In w. Europe the danger of intra-mural burial was acknowledged and the practice prohibited at the French Revolution; and in 1804, under Napoleon, the famous cemetery of Père-Lachaise was laid out. England and the U. S. gradually followed the example, and the national cemeteries of Arlington, Gettysburg, etc., are further extensions of the park system. See DISPOSAL OF THE DEAD.

Cenci, BEATRICE, 1577–1599. Italian, executed for the

Beatrice Cenci.

murder of her cruel father. Her supposed portrait by Guido Reni is celebrated.

Cenis. See MONT CENIS.

Cennick, JOHN, 1718–1755. English hymnist; helper of Wesley and Whitefield; from 1745 a Moravian.

Cenogeny, or CENOGENESIS. Modifications in the development of any animal, undergone to fit it for changing conditions or to reach an advanced stage with least trouble. Accordingly the large amount of yolk has been secondarily acquired by the fowl's egg, that the young might be hatched in a nearly perfect condition, complex though the organization may be. See DEVELOPMENT.

Cenotaph. Empty tomb or monument; originally raised to lost travelers or heroes; also a mausoleum built for a man during his lifetime.

Censer. In the R. C. church, a perforated vessel in which incense is burned, also called thurible. Censers of various kinds are found in the sculptures of Egypt, Greece, and Rome. The censer played an important part in the Jewish temple-service.

Censors. Two officers of authority second only to that of dictator in Rome during the Republic. Their duties were to take the census with exact returns of all property, and to impose taxes accordingly, and to regulate public morals by inflicting upon offenders a public mark of ignominy. From their decisions the only relief was an appeal to an assembly of the citizens. Instituted in 443 B.C., the office was filled by patricians only until the election of a plebeian in 351 B.C. Both censors were plebeians first in 131 B.C. The censorship lasted until the Empire.

Census. Enumeration of inhabitants. Said to have been instituted in Rome 555 B. C., and taken every 5 years. Special officers, known as censors, were first appointed 443 B. C. During the Middle Ages few statistics were collected. The Domesday Book of England was a register of the lands in the several shires, with the slaves and cattle on each estate. The first scientific census was made by Sweden 1749. The U. S. took its first census 1790. Its chief object was to fix the representation in the lower branch of Congress, each State being entitled to one representative, but additional representation depending on the number of inhabitants. Since that time the scope of the census has broadened, and now includes details of sex, age, nationality, family, occupation, wealth, and other subjects. In France and Germany a census is taken every fifth year; in England and other European states, as in the U. S., it is decennial.

Cent. Coined in the U. S. in copper 1793–1857 (except 1815), and from 1856 in alloy; copper 97, tin 2.8, zinc 0.2. The French centime is $\frac{1}{100}$ of a franc and $\frac{1}{8}$ of a sou or cent.

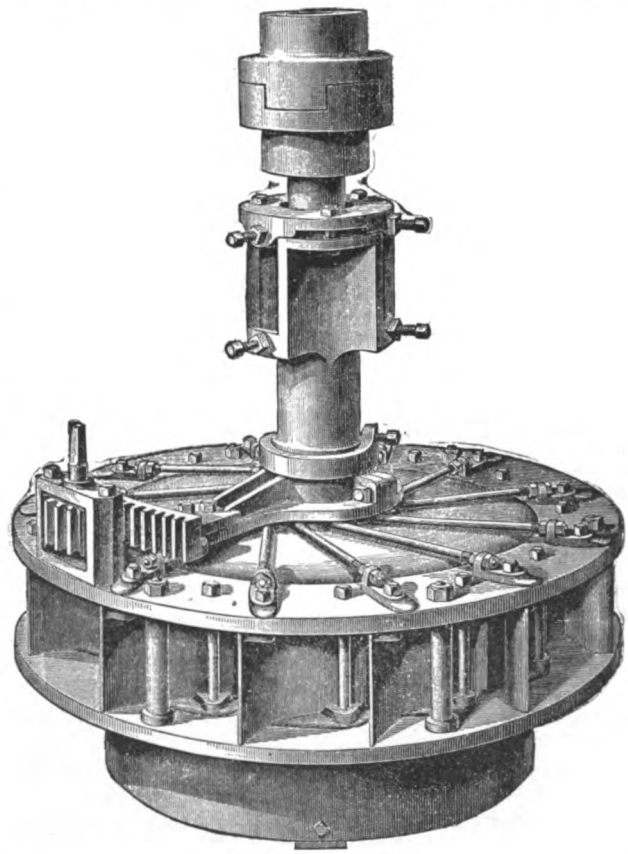
Centaurs. Mythical race; men from the waist up, but with the bodies and legs of horses.

Centaury. Plants of the genus *Erythrea*, natural family *Gentianaceæ;* natives of the Old World, introduced in N. America.

Centaury, AMERICAN. Plants of the genus *Sabbatia*, natural family *Gentianaceæ;* natives of e. N. America.

Centennial Exhibition. Held at Fairmount Park, Phila., 1876, to celebrate the hundredth anniversary of the Declaration of Independence and exhibit the progress of the U. S. after a century of national life. On grounds, 284 acres in extent, five large buildings were erected at a cost of $4,500,000. They were known as Main and Machinery Buildings, Art Gallery, and Agricultural and Horticultural Halls. The Art Gallery, built of granite, iron, and glass (365x210x59 ft.), was called Memorial Hall and remains as a permanent home of art. Besides these ab. 200 other buildings were erected by various foreign governments (35 of which participated), States of the Union, and corporations. The Exhibition was open from May 10 to Nov. 10, and the attendance numbered 9,910,966. The total area of buildings was 70 acres. The number of exhibitors was 40,000. The total receipts, $4,300,000.

Center Flow Wheel. Turbine water wheel in which



Center Flow Wheel.

the water enters around the circumference and escapes near

the axis, usually in a downward direction. The figure shows the Leffel turbine wheel, where the guides for admitting the water are between the two horizontal circular rims.

Center for Arches. Timber structure whose upper surface is shaped like an arch, and upon which the stones of the arch are laid in position. When the arch is completed and the mortar well set, the center is removed. The only arch probably ever built without a center is the great steel arch of the St. Louis bridge; in this suspension ropes and guys were employed.

Center of a Plane Curve. Point in the plane of the curve bisecting every straight line passing through it, and terminated by the curve.

Center of a Surface. Point bisecting all straight lines drawn through it and terminated by the surface.

Center of Buoyancy. When any body is wholly or partly immersed in a fluid, the center of mass of the displaced fluid is called the "center of buoyancy." Through this point passes the resultant buoyant force which is equal to the weight of the fluid displaced.

Center of Curvature. Center of the osculating circle at any given point of a curve. The locus of all the centers of curvature of any curve is the evolute of that curve.

Center of Figure. That point in any body which occupies a position the distance of which from each one of three mutually rectangular planes is the average distance of all the points of the body. If the body be homogeneous and symmetrical about its center of mass, the latter point and its center of figure are coincident.

Center of Flotation. Center of buoyancy.

Center of Gravity. Coincident with the center of mass of a body; center of parallel forces where the forces consist of the weights of all the particles composing the body.

Center of Inertia. Center of mass.

Center of Mass. Point in any body through which the resultant of a number of parallel forces acting upon the body will pass, in whatever position the body is turned, each force being proportional to the mass of the part upon which it acts.

Center of Oscillation. Point in a compound pendulum so situated that if the pendulum be suspended from it the period of oscillation will not be changed. The distance between the center of suspension and that of oscillation is the length of a simple pendulum having the same period.

Center of Parallel Forces. Point through which the resultant of any number of parallel forces acting upon a rigid body passes, in whatever position the body is turned. As the behavior of such a body is clearly the same as if its mass were concentrated at the center of parallel forces, this point is called the center of mass, or the center of inertia of the body. If the system of parallel forces consists of the weights of all the molecules composing the body, the point is known as the center of gravity.

Center of Percussion. If any point of a rigid body be fixed, there is always another point, within or without the body, through which, if an impulse be applied perpendicular to a straight line joining the two points, there will be no stress exerted at the fixed point. This second point is the center of percussion, and is coincident with the center of oscillation in a compound pendulum.

Center of Pressure. Point at which a single force must be applied to exactly balance a body subjected to water pressure on one side. That of a dam of height h is at $\frac{2}{3}$ h below the surface of the water, if no overflow occurs.

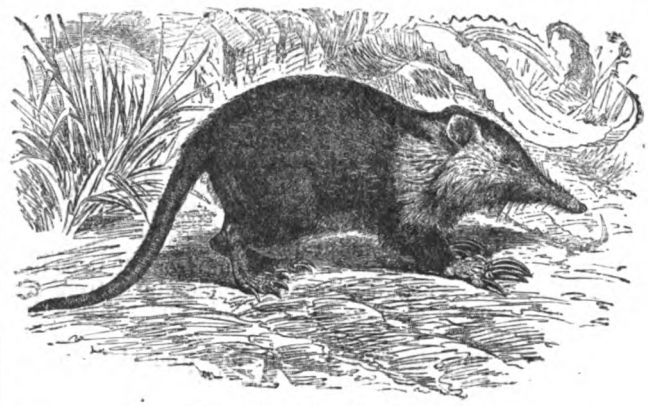
Center of Similitude OF TWO CIRCLES. Point of intersection of all the straight lines joining the extremities of parallel radii; direct when the radii are similarly directed in each circle, inverse when they are oppositely directed.

Center of Suspension. Fixed point in a pendulum, about which it oscillates. This point is interchangeable with the center of oscillation of a compound pendulum without a change of period in the pendulum.

Center of Symmetry. Point about which the elements of a figure are symmetrically arranged.

Center, RADICAL. Point where the radical axes of three circles intersect.

Centetidæ. Family of *Insectivora*, including the Tanrecs of Madagascar and the Solenodon of the W. Indies. The latter is shrew-like, with elongated snout, long scaly tail, and covered with coarse fur. The former is a small hedgehog-like animal, with spiny bristles intermixed with the hair. The



Centetidæ (*Solenodon cubanus*).

muzzle is long and pointed, the tail short or absent. There is no zygomatic arch nor tympanic bulla.

Centigrade. Thermometer in which the boiling point of water is 100° and the freezing point 0°. This scale was devised by Celsius.

Centipedes. See CHILOPODA.

Centlivre, SUSANNAH, ab. 1667–1723. English dramatist. Her 19 plays were pub. 1761 and 1872.

Central America. Portion of the American continent between Mexico and S. America. It includes GUATEMALA, BELIZE HONDURAS, SAN SALVADOR, NICARAGUA, and COSTA RICA (q.v.).

Central American Antiquities. See AMERICAN ARCHITECTURE.

Central Capsule. Spherical hollow body in which the nucleus lives in certain *Radiolaria*. It serves as a point of attachment for the radiating spicules of the skeleton in some forms.

Centrale. Bone lying between the proximal and the distal rows of carpal or tarsal bones.

Centre College. At Danville, Ky.; chartered 1819. It has a law department with 3 professors and 4 lecturers, 12 instructors, and ab. 200 students in the collegiate grade, 90 pupils in preparatory school, and productive funds about $175,000.

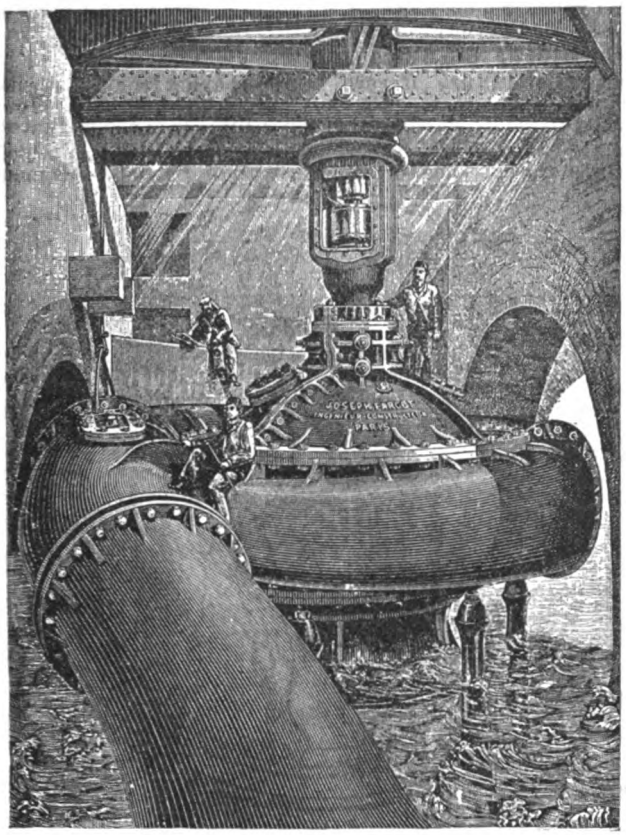
Centrifugal Dryer. Machine to remove water or other fluid from among the solid matters which are charged into the machine. A cylindrical vessel or "basket" is mounted so as to revolve around a vertical axis, which is supported above or below, and driven by a belt or friction-cones at high speed. The vertical sides of the basket are perforated or are made of wire netting, and the centrifugal force acting on all the matter which is charged forces it out radially against the sides. The fluid passes through the perforations, the solid remains behind. This dryer has been also called a hydro-extractor; it is applied in sugar, glue, and chemical manufacture, and for laundry use. Special care has to be taken to steady the axis of the revolving basket by springs, inasmuch as its contents may not be evenly distributed on the sides, which throws the balance out and causes very unsteady motion. The discharged fluid is caught within an exterior casing.

Centrifugal Force. That which must be exerted to cause a revolving mass to keep at a fixed distance from the axis of rotation. The inertia of a body gives it a tendency at every point of its revolution to move in the direction of tangents at those points; this tendency can be overcome only by a force acting toward the center; the resistance to this, caused by the inertia of the body, is the centrifugal force. If v denote the velocity of the body, and f the acceleration due to centrifugal force, and r the radius of curvature of the path of the body, $f = \frac{v^2}{r}$. This force, generated by the diurnal revolution of the earth, diminishes the effect of gravity at all points except the poles. At the equator, where it is a maximum, the diminution is one pound in 289.

Centrifugal Inflorescence. See CYMOSE.

Centrifugal Pump. One in which the fluid to be moved is set in rapid rotation by means of blades or vanes. The inertia of the fluid sends it radially outward against the casing of the vanes, and it escapes through one or more tangential outlets. The inlet is at the center in line with the axis. These pumps deliver large masses of fluid, and have given their best efficiency at low lifts. As they have no valves, they are spe-

cially adapted for wrecking or draining purposes, for handling



One of the great centrifugal pumps at Khatetbeh, Egypt, built by Farcot, France.

sewage, and mud or sand in water, and for similar uses. When used for air or gases, they are called centrifugal fans.

Centripetal Force. When a body is constrained to move in a curved path the constraint is due to a force perpendicular to the path at every point. This centripetal force is equal to $\frac{mv^2}{r}$, in which m is the mass of the moving body, v its velocity, and r the radius of curvature of the path at the point considered.

Centripetal Inflorescence. See BOTRYOSE.

Centripipeda. See ALLOPOLA.

Centrobaric. Body such that the attractive action of any mass upon it is reducible to a single resultant, the direction of which always passes through one point fixed relatively to the body, whatever its position in relation to the attracting mass. The fixed point is the center of gravity or of mass, and in a centrobaric body it necessarily lies in its interior. The outer boundary of every centrobaric body is a single closed surface.

Centrodorsal Plate (OF CRINOIDS). Plate of the calyx to which the stem is attached, on the aboral side.

Centroid, or CENTRODE. Curve which is the locus or series of positions of the instantaneous centers around which a moving body may be conceived as having revolved. If such a curve be found for a designated motion of a body, that motion may be reproduced by the rolling upon each other of two centroids, one of which is fixed in space and the other considered as rigidly attached to the moving body. See INSTANTANEOUS CENTER.

Centrolecithal. Eggs in which the yolk is uniformly surrounded by a layer of protoplasm, as in many insects.

Centrolepideæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Monocotyledones*, comprising 6 genera and ab. 32 species, nearly all natives of Australia.

Centrosome. Central particle of the centrosphere.

Centrosphere. Spherical body associated with the nucleus of plant cells.

Centuries of Magdeburg. Earliest Protestant Ch. history, written by Matthias Flacius and others, and pub. in 13 vols. 1559–74; answered by BARONIUS (q.v.).

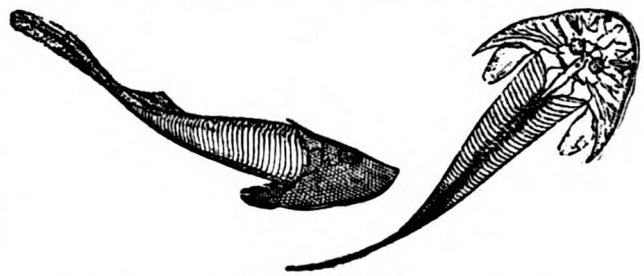
Centurion. Commander of a sixtieth part of a legion of Roman infantry; originally 100 men, later indefinite.

Century Association. Located in New York City. Literary and artistic club, founded 1847, 1,000 resident and 300 non-resident members.

Century Plant. *Agave Americana.* Large succulent plant of the Amaryllis family, native of the arid regions of Mexico, which blooms only at long intervals.

Cephalaspidea. Order of Ganoids, including Palæozoic fossils, with enameled scales forming a complete armor, the head incased in a continuous shield, and the skeleton cartilaginous.

Cephalaspis. Armor-clad Devonian fish (?) having its head



Cephalaspis Lyellii.

fully one-third of its entire length, and covered on the whole upper side with a crescent-shaped buckler.

Cephalic Cones. Two processes beset with suckers on the head of the Pteropod *Pneumodermon.*

Cephalic Disc. Anterior sucker of the leech.

Cephalic Flexure. Upward bend of the axial line of sternites as one passes forward into the head region of lobster. By this means the appendages in front of the great claws point forward and serve the mouth.

Cephalic Segments. Those which have coalesced to form the head. These are probably 4 for insects, 8 or 9 in the crab-like animals, and 9 to 13 in the vertebrates.

Cephalideæ. Family of Fungi of the order *Mucorini.*

Cephalization. Concentration and modification of the anterior segments of a metameric animal to form a head. This part then subordinates all the remaining segments of the body to its service.

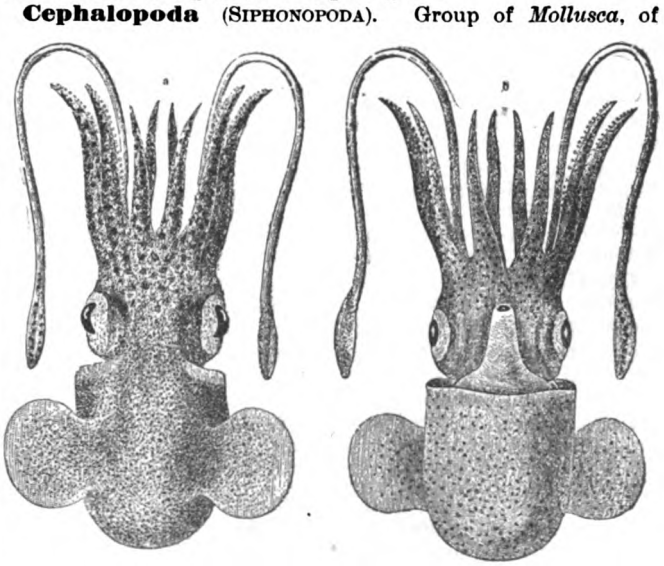
Cephalobranchiata. Group of *Chætopoda* worms, having gills on the head and generally living in tubes. It includes *Sabella, Serpula,* etc.

Cephalochorda. See CHORDATA and LEPTOCARDIA.

Cephalodium. Minute protuberances on the Lichen thallus.

Cephalophora (GLOSSOPHORA, ODONTOPHORA, or ENCEPHALA). Division of *Mollusca,* including forms with a more or less conspicuous head. Here belong the groups *Scaphopoda, Gastropoda, Pteropoda,* and *Cephalopoda.*

Cephalopoda (SIPHONOPODA). Group of *Mollusca,* of



Sepiola Rondeletii. (a) Back. (b) Ventral view.

which the Squids and "Devil-fish" are examples. The forms possess a distinct head, with a mouth containing jaws like a

parrot's beak, and a radula having medium teeth flanked by three hooks on each side. Around the mouth is a circle of arms, bearing suckers, or of tentacles. A funnel, made from the fusion of structures homologous with the epipodium (or fins) of Pteropods, is present on the ventral side. The posterior surface is ventral and contains the mantle cavity, in which are two (or four) gills, and the openings of the excretory organs. A shell may be present and external, or may be rudimentary and internal. The skin contains chromatophores. The ganglia are supported by cartilages. The sexes are separate; fertilization is effected by means of a hectocotylized arm of the male, bearing spermatophores. Some are used for food. They are often of large size. Two orders are included, the *Tetrabranchiata* and the *Dibranchiata*. In a broad sense the above term also includes the *Pteropoda*.

Cephalostegite. Part of the Branchiostegite lying in front of the cervical groove, in the carapace of lobsters.

Cephalota. Group of Dendrocœlous worms, possessing distinct heads.

Cephalothorax. Anterior and main part of the body of crabs and lobsters, in which the head and thorax are solidly anchylosed together.

Cerambycidæ. See TETRAMERA.

Ceramiaceæ. Order of red Algæ, comprising many of the more delicate and beautiful species.

Ceramics. Art of pottery-making, and oldest of all the arts; for the rudest savage must soon have artificially applied the natural process of rain-softened and sun-burned clay. The potter's wheel appears on the Theban monuments, having probably traveled westward from China. In historical research the evidence afforded by ceramics is invaluable since it was the means by which antiquity honored its dead. By the pottery of the tombs we learn the life of forgotten nations, and trace the geographical limits of successive races and empires. The potter's art was highly honored: there was a potter to the King of Judah, Numa established a potter's college in Rome and the Chinese Emperors multiplied decrees for the production of impossible porcelains and richly rewarded new varieties. European royal patronage came much later. Majolica was introduced by the Dukes of Urbino, and we owe the ware of Palissy to the encouragement of Henry II., Diana of Poitiers and Catherine de Medicis. In the 18th cent. Maria Theresa, Frederick the Great, Elizabeth and Catherine II. established at their own expense porcelain manufactures in their respective dominions; by the influence of Pompadour and Dubarry over Louis XV., Sèvres was brought to perfection and Wedgwood produced Queen's Ware under the patronage of Queen Charlotte. See POTTERY.

Ceramidium. Sacs containing the spores in certain of the red Algæ.

Ceraospongia (CERATOSPONGIA). Sponges with a skeleton of horny fibers like the common bath sponge (*Spongia* and *Euspongia*). Sand-grains may be imbedded in the fibers. They are all marine, and found in warm seas, as in the Mediterranean and the West Indian seas. Sponges are prepared for market by being torn from the bottom by tongs and exposed out of water until death ensues; then the sponge is replaced in salt water until the animal matter is removed; then they are taken up, dried, bleached, and trimmed. The bleaching is best effected by peroxide of hydrogen or permanganate of potassium.

Cerargyrite (HORN SILVER). AgCl. Silver chloride containing 75 per cent of silver; highly valued as an ore.

Cerasin. Gum of the cherry. Little soluble in water, but swells to a viscous condition.

Cerata. Division of Arthropods, including the groups usually classed as *Tracheata* or *Insecta*, i.e., *Hexapoda*, *Myriapoda*, and *Peripatus*. Have one pair of antennæ, true processes of the procephalic lobes, and not homologous with the antennæ of *Crustacea*, which originate as post-oral appendages.

Cerata. Gill-like processes on the back of certain Opistho branchs into which the intestine also often sends processes.

Ceratium. See CILIOFLAGELLATA.

Ceratobranchial. External and middle parts of the branchial arches, articulating with the epibranchials above and the hypobranchials below.

Ceratodus. Crossopterygian Lepidoganoid fish of the Trias, with tubercular teeth covering the surface of its mouth and a fringed tail extending on both sides of its body. With *Ctenodus* and *Dipterus*, it belongs to a group allied to the modern *Dipnoi* (Mudfishes); they were herbivorous, and probably breathed through lungs as well as gills. See MONOPNEUMONA.

Ceratohyal. Part of the hyoid arch corresponding with the ceratobranchials.

Ceratonota. These Opisthobranchs have cerata on the back, and the ctenidium is not developed. See AILOBRANCHIA.

Ceratophyllaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, including 1 genus and ab. 5 species, all aquatic, found in all parts of the world; the Hornwort family.

Ceratosa. See KERATOSA.

Ceratosaurus. Horned reptile having some bird-like characters, a skin like that of a crocodile, and carnivorous habits; found by Marsh in the Upper Jurassic of the w. States.

Cerberus. Three-headed dog with serpent's tail, which guarded the entrance to the under world. Fetching this monster to earth without force of arms formed the 12th labor of Hercules.

Cerberus.

Cercaria. See DISTOMUM.

Cercopithecidæ. See CYNOPITHECIDÆ.

Cerci. Appendage borne by the 10th abdominal segment of the grasshopper. They lie on the external side of the podical plates.

Cerdic. Founder of the kingdom of Wessex 495, and of the royal house of England; opposed by Arthur.

Cere, or CEROMA. Membrane at the base of the upper mandibles of birds, in which the nostril opens.

Cerealin. Nitrogenous body found in the bran or husk of many cereals, which has the property of converting starch into dextrin 40° C. to 70° C.

Cerebellum. Portion of the brain in the hinder and lower part of the skull, beneath the cerebrum and behind the medulla oblongata, consisting of two connected lateral halves, indented with transverse, somewhat curved, closely placed furrows. It consists internally of white nerve tissue, and externally of gray, so arranged that its sections resemble the foliage of the Arbor-Vitæ. A now abandoned view was that it was the seat of the sexual instinct, but all that is known of it is that it controls the balancing of the body and possibly assists in the co-ordination of muscular movements.

Cerebral Ganglia. Masses of gray nerve matter at the base of the brain, which are supposed to store up or modify nerve force. Term also applied to head ganglia of Invertebrates.

Cerebritis. See ENCEPHALITIS.

Cerebro-Pedal Commissures. Nerves which unite the cerebral to the pedal ganglia in molluscs.

Cerebro-Spinal Meningitis. Inflammation of the membranes covering the spinal cord and brain, characterized by fever, severe pain, and paralysis of various portions of the body, the two latter depending upon the portion of the nervous centers affected. A contagious and very fatal variety has prevailed in an epidemic form at various times, and on account of the occurrence of an eruption in many cases has been termed Spotted Fever.

Cerebro-Splanchnic Commissures. Nerves which unite the cerebral and the splanchnic ganglia of clams, snails, and other molluscs.

Cerebrum. Larger portion of the brain, most intimately connected with all the phenomena of life and thought. It consists of two lateral halves, the hemispheres, each resem-

bling an ovoid flattened on one side, united together and connected with the cerebellum and medulla oblongata. The outer surfaces are divided in a complicated manner by a number of fissures, between which are the convolutions, and in the interior are several cavities, the ventricles. Internally it consists principally of white nerve tissue, with several collections of gray matter, and externally of gray tissue made up of a number of microscopic layers, the extent of which depends largely upon the number and complexity of the convolutions, and is believed to determine the intelligence. See BRAIN.

Ceremonies, MILITARY. Prescribed by regulations, and intended to enhance the pride and *esprit de corps* of the troops, as well as to improve discipline; among these are Parades, Reviews, Inspections, Escorts of the Colors, Escorts of Honor, Funeral Honors, and Guard Mounting.

Ceres. Roman goddess of the earth, protectress of fruits and farms; same as Demeter of the Greeks; sister of Jupiter

Ceres (Vaticano).

and mother of Proserpine. who was stolen from her by Pluto. The Eleusinian Mysteries were held in her honor.

Ceres. Asteroid first discovered; found by Piazzi at Palermo, Jan. 1, 1801. Distance from sun 257,000,000 m.; period 4.604 years; diameter ab. 200 m.

Ceresine. See OZOKERITE.

Ceresuola. In n. Italy; scene of defeat of Imperialists by Francis de Bourbon, April 14, 1544.

Cereus. Genus of *Cacteæ*, including both diurnal and nocturnal bloomers, generally bearing showy flowers, natives of tropical America.

Cerianthidæ. See MALACODERMATA.

Ceriferous. Wax-bearing; organs covered with wax, as the fruit of the Bayberry.

Cerignola. Town of s. Italy; here the Spaniards under Gonsalvo da Cordova defeated the French under the Duc de Nemours, April 28, 1503. Pop. ab. 25,500.

Cerinthus. Jewish Christian, ab. 100; founder of a Gnostic sect. Legends bring him into collision with St. John.

Cerite. Mineral found in Sweden, containing the rare chemical elements, cerium, lanthanum, and didymium.

Cerium. Ce. At.wt. 139.28, Sp. gr. 6.72, Sp. ht. .0448. Mpt. bet. 450° C. and 950° C. Discovered by Klaproth 1803; rare element, occurring in cerite; prepared by electrolysis of its chloride. It forms two series of compounds, in one of which it is trivalent, resembling aluminium; in the other quadrivalent, resembling silicon.

Cernuous. Drooping structures, as flowers of the *Fuchsia* and branches of the Weeping Willow.

Cernuschi, ENRICO, b.1821. Italian bimetallist, living mostly in France. *Mechanism of Exchange*, 1865; *Silver*, 1876.

Cerotic Acid. $C_{27}H_{54}O_2$. Mpt. 78° C. Solid, fatty acid, main constituent of beeswax, and present in combination in Chinese wax; prepared from beeswax by means of alcoholic solution.

Cerro Gordo. In Mexico; scene of defeat of Santa Anna with a force of over 12,000 by Gen. Scott with 9,000, April 18, 1847.

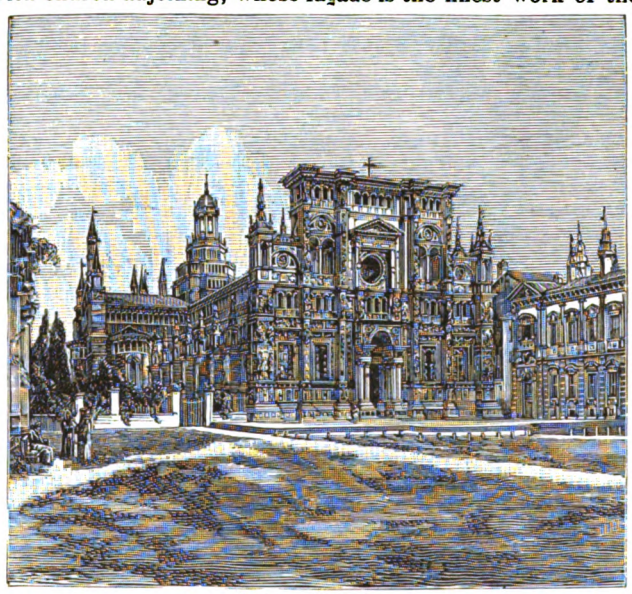
Certainty. Absolute assurance in conviction; distinguished from both probability and possibility.

Certificate. Written statement of facts by one duly authorized; often required to be authenticated in a particular manner.

Certificates, In the military service a certificate of merit may be awarded to a soldier by the President for extraordinary acts of gallantry in the presence of an enemy, which confers on the soldier $2 extra pay per month. Medical certificates are required before sick leaves are granted to officers, and certificates of disability for the discharge of enlisted men. All vouchers for expenditure of public money require the certificate of an officer.

Certiorari. Writ issued by a Superior Court to an inferior tribunal or officer, commanding a return of the records of a cause there depending, for review. It is generally regulated by statute, and is often employed to correct illegalities in tax and assessment levies. See APPEAL.

Certosa di Pavia. Secularized Carthusian monastery with church adjoining, whose façade is the finest work of the



Certosa di Pavia.

kind in the 15th century; begun by Ambrozio Borgognone 1473. The Dukes of Milan founded it 1396.

Ceruminous Glands. Wax glands that secrete the powdery or woolly substance surrounding certain insects, *e.g.*, the bark lice.

Cerussite. $PbCO_3$. Lead carbonate, valuable as an ore of lead, and frequently argentiferous.

Cervantes, VICENTE, 1759–1829. Mexican botanist.

Cervantes Saavedra, MIGUEL DE, 1547–1616. Spanish novelist and dramatist, wounded at Lepanto 1571, captive in Algiers 1575–80. His immortal *Don Quixote*, 1605–16, was written in prison ab. 1599, "to render abhorred of men the false and absurd stories" of chivalry. His other chief works were two pastoral romances, *Galatea*, 1584, and *Persiles and Sigismunda*, 1616; 12 short tales, 1613; and over 20 plays, of which few are extant. His tragedy, *Numancia*, has won high praise.

Cervical Groove. Crossing the carapace of the lobster near its middle part, and running forward on each side to the edge of the branchiostegite.

Cervidæ. Deer family, of the group *Pecora*; characterized by having the feet two-toed (with rudiments of two other toes). Horns are present in the males (also females in Rein-

deer), which are bony throughout and solid, and are annually shed after the close of the breeding season. They first appear in the second year as simple prongs, and each time they are reproduced they are larger, and add branches and tynes. While growing they are covered by vascular skin (velvet). This forms a burr or ridge, separating a pedicel from the outer beam, and serves to cut off the blood supply of the beam, which then ceases growth; the skin dries up and peels off. Upper canines are generally absent (exceptions are in males of some species), and there is a brush of hairs on the inside of the hind foot, which is one feature distinguishing Deer from Antelopes. The females have four mammæ, but usually bear only one young. There are no Deer s. of the Sahara, nor in Australia. See DEER.

Ceryl Alcohol. $C_{27}H_{55}OH$. Cerotine; in combination with cerotic acid in Chinese wax; obtained from it by saponification.

Cesalpino, ANDREA, 1519–1603. Italian botanist. *De Plantis*, 1583.

Cesari, ANTONIO, ab. 1750–1828. Italian critic and novelist.

Cesari, or **Arpino,** GIUSEPPE, ab. 1568–1640. Italian painter.

Cesarotti, MELCHIORE, 1730–1808. Italian poet, prof. at Padua from 1750; tr. Ossian 1763, Homer, and Juvenal. *Philosophy of Language*, 1785.

Cesnola Collections. Cypriote antiquities in N. Y. Metropolitan Museum. Collected by Gen. Luigi Palma di Cesnola, b. 1832. U. S. Consul to Cyprus 1865; director of the Museum 1877. The collections consist of statues, terra-cotta idols, and figurines from temples, shrines, and tombs; of glass, pottery, gems, and jewelry, also from tombs; and of other miscellaneous antiquities. The archæologic value of all these objects is due to the peculiar position of Cyprus in ancient history as one of the connecting links between Greek and Oriental civilization. No other collection so conclusively demonstrates the Oriental origins of Greek art. Their value as museum exhibits is, however, damaged by confused arrangement, having no reference either to chronology, style, or locality of finds.

Cespedes, PABLO DE, 1536–1608. Spanish painter, poet, and architect.

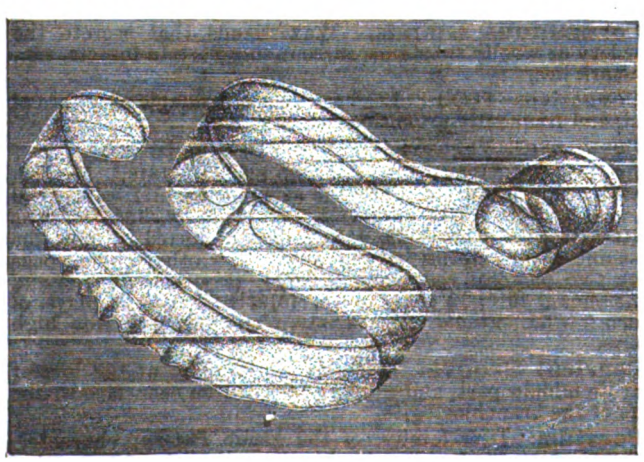
Cespedes y Borges, CARLOS MANUEL DE, 1819–1874. Leader of a Cuban insurrection 1868.

Cessation of Arms. Armistice or truce, agreed to by the commanders of belligerent forces, as for capitulation or burying the dead.

Cessions to the United States. 1781, by New York the territory from lower side of the Great Lakes across the Ohio Valley to the Cumberland Mts.; 1784, by Va. that n. w. of the Ohio; 1785, by Mass. that west of w. boundary of N. Y.; 1786, by Conn. that e. of the Mississippi between 41° and 42°, and w. of meridian drawn 120 m. w. of the present w. boundary of Pa.; 1800, by Conn. that within the same n. and s. limits to the present w. boundary of Pa.; 1787, by S. C. that forming the n. portions of Ga., Ala., and Miss·; 1789, by N. C. that forming Tenn.; 1782, by Ga. that between w. boundary of Ga. and the Mississippi; 1803, by France the Louisiana Purchase: 1819, by Spain e. and w. Florida; 1828, by Texas, Texas; 1848, by Mexico, Cal., N. Mex., and Arizona; 1852, by Mexico, Gadsden Purchase; 1867, by Russia, Alaska, acquired by purchase.

Cesspool. Subterranean vault for receiving and storing sewage, the contents being emptied at stated intervals. When the bottom is open so that the contents soak away into the soil, it is called a sinkhole. Cesspools in cities or large towns are a source of danger to health.

Cestidæ (TÆNIATÆ). Band or strap-shaped Ctenophores, of which "Venus's Girdle" is typical. The body is greatly elongated in the stomach plane, the oral and aboral poles lying in opposite margins at the middle of the band. The tentacular furrow extends on the sides toward both ends of the body, and in it the tentacle is attached, leaving the lateral tentacles free.



enus's Girdle (*Cestus Veneris*).

Cestoda (CESTODES, TAPEWORMS). Elongated, usually segmented, Platyhelminthes, with no mouth or intestines, and having organs for attachment, at the anterior end. The body is really a chain of proglottides, which, as fast as they become sexually mature, usually become detached. See TÆNIADÆ and BOTHRIOCEPHALIDÆ.

Cestracion. See CESTRAPHORI.

Cestraphori, or HETERODONTIDÆ. Group of selachian fishes, characterized by a pavement of plate-like crushing teeth. The Port Jackson Shark (*Cestracion*) from the Pacific is the only living representative. Numerous fossil representatives of the family are known, especially from the Carboniferous strata.

Cestui Que Trust. He for whom a trust is created;—*que use*, he for whom a use exists;—*que vie*, he for whose life an estate is granted.

Cestus. Girdle of Greek and Roman women; also, boxer's gauntlet.

Cetacea (CETACEA-CARNIVORA, WHALES, etc.). Order of adeciduate placental Mammals, with fish-shaped, hairless body, the fore limbs modified as fin-like flippers, the hind limbs absent, a horizontal caudal fin, and sometimes a dorsal fin. The eyes are placed near the gape; the head is large, and no neck is present. The nostrils open on the top of the head as the "blow-holes" or spiracles. But one set of teeth is present, and this is usually lost in fœtal life. The lungs are very long; the mammæ are situated in the groin, and but one young is born at a time. They are carnivorous and often of great size. They are hunted for the oil which a heavy layer of sub-cutaneous fat affords. They are viviparous and warm blooded. Three sub-orders are included: *Archæoceti*, *Mystacoceti*, and *Odontoceti*.

Cetacea Herbivora. See SIRENIA (Placentalia).

Cetyl Alcohol. $C_{16}H_{33}OH$. Mpt. 50° C. Ethal. White solid. Combined with palmitic acid as cetyl palmitate, it is the main constituent of spermaceti.

Cevennes. Range of mountains in s. France, w. of the Rhone. Elevation between 3,000 and 6,000 feet.

Ceylon. A large and populous island s. of India, separated

Ceylon.

from it by the Gulf of Manaar and Palk Strait. It belongs to Great Britain. The s. interior is mountainous, but most of it is fertile and very productive. Length 270 miles, maximum breadth 140 m., area 25,400 sq. m. It was known to the ancients as Taprobane. The Portuguese established a factory here 1517. The island was seized by the Dutch 1603, who subdued it ab. 1658; seized by the British 1795, and ceded by the peace of Amiens 1802; the King of Kandy was overthrown 1815. Pop., 1891, 3,008,466.

Ceylonite, or CEYLANITE. $MgAl_2O_4+FeAl_2O_4$. Variety of spinel containing iron.

C. G. S. System. Absolute system of units, in which the fundamental units are the centimeter as the unit of length, the gram as the unit of mass, and the second as the unit of time.

Chabaneau, CAMILLE, b. 1831. French writer on Provençal languages and literature; prof. Montpellier 1879.

Chabas, FRANÇOIS, 1817–1882. French Egyptologist.

Chabazite. One of the zeolite group of minerals.

Chablis. One of the white wines of Burgundy; for richness and delicate flavor it is highly esteemed. It is grown in the Department of Yonne. See BURGUNDY WINES.

Chabrias, d. 357 B.C. Athenian commander.

Chabrier, ALEXIS EMMANUEL, 1841–1894. French musical composer. *Espana*, a rhapsody for orchestra; *Gwendoline*, an opera.

Chacarnac, JEAN, 1823–1873. Astronomer at Paris Observatory from 1854. He constructed a series of charts of small stars near the ecliptic, which have been useful in searching for Asteroids.

Chaconne, or CIACONNA. Stately dance of French or Spanish origin, generally in 3-4 time and slow movement. As a musical form it belongs to the class of variations, its foremost example being found in Bach's 4th violin sonata.

Chad, or TSAD. Large lake of central Africa, s. of the Sahara. Into it flow many large streams; it has no outlet.

Chad, ST., d. 672. Bp. of York 664, and of Mercia 669.

Chadbourne, PAUL ANSEL, D.D., LL.D., 1823–1883. Pres. Univ. Wis. 1867–70; pres. Williams Coll. 1872–80. *Instinct*, 1872.

Chadwick, GEORGE WHITEFIELD, b. 1854. American composer; author of three symphonies, chamber music, cantatas, songs, the *Columbian Ode* for the dedication of the Chicago World's Fair 1893, and a comic operetta, *Tabasco*.

Chadwick, JOHN WHITE, b. 1840. Unitarian pastor in Brooklyn since 1864. *Aspects of Religion*, 1879.

Chæremon. Athenian dramatist of 4th century B.C.

Chæremon. Writer on Egypt in 1st century.

Chæronea. Town of Bœotia, where Greece lost her liberties through defeat of Athenians by Philip 338 B.C. Here Sulla defeated Mithridates 86 B.C., and Plutarch was born A.D. 50.

Chætifera (ARMATA, ECHIUROIDEA). Gephyrean worms, having a terminal anus and two strong, ventral hooks. The præoral lobe is developed into a proboscis, which is long and forked in *Bonellia*. The larva shows segmentation of the body. The male *Bonellia* is a small Planarian-like organism, parasitic in the oviducts of the female. *Thalassema* lives in *Echinoids*.

Chætocladieæ. Small family of *Fungi* of the order *Mucorini*.

Chætoderma. See ISOPLEURA.

Chætodontidæ. Family of Acanthopterygian fishes, comprising a number of brilliantly colored tropical fishes, in shape somewhat similar to our sunfishes. They frequent coral reefs, and some of them are excellent for food. The Angel Fish of the Bermudas and West Indies attains a wt. of 4 lbs., but most of the species are smaller.

Chætognatha. Class of Vermes including SAGITTA (q.v.).

Chætonotus. See NEMATORHYNCHA.

Chætophoraceæ. Order of filamentous green *Algæ*, occurring in fresh water.

Chætopoda. Free-living Annelids, with paired tufts of setæ on the segments, with distinct head, and with tentacles, cirri and branchiæ. They form the orders *Polychæta* and *Oligochæta*.

Chætopterus. Tubicolous Annelid, living in a parchment-like tube. Several dissimilar regions can be distinguished in its body. There are two or four long tentacular cirri on the head, and lobed, wing-like processes on the back.

Chætopterus.

Chaff. Glumes of grasses, and bractlets which subtend flowers on the receptacles of plants of the Composite family.

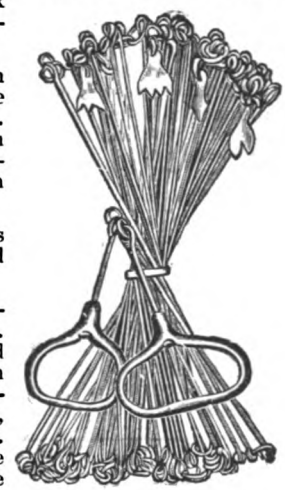
Chaffseed. *Schwalbea americana*. Plant of the natural family *Scrophulariaceæ*, native of s. e. N. America.

Chagres Fever. Malarial fever, dangerous and difficult to relieve, prevalent in tropical countries; named from the Chagres River, in Isthmus of Panama.

Chailletiaceæ, or DICHAPETALÆ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 3 genera and ab. 54 species, growing in the tropical regions of both hemispheres.

Chaillu, PAUL DU. See DU CHAILLU.

Chain. Linear measure used by surveyors, either 66 or 100 ft. in length, consisting of 100 links, so that it can be folded as in the figure. For town or city work a steel tape is now generally employed instead of a chain.



Surveyor's Chain.

Chain Bridge. Suspension bridge in which the cables are formed of chains instead of wire. The system is but little used in modern suspension bridges, although a few have been built with the cables made of eye-bars.

Chain-Fern. Ferns of the genus *Woodwardia*, a widely distributed group.

Chaining. Processes of measuring a line with a surveyor's chain. A pin is placed to mark the end of the chain while it is moved on to the next position. As horizontal distances are always required, the chain should be held nearly level. The precision of chaining is low, the uncertainty in the length of a line being usually greater than one one-thousandth part.

Chain-Mail. Flexible armor formed of interlaced rings, four hammered being connected by one riveted. Adopted by the Crusaders from the Saracens, it was universally in favor in Europe during the 14th century and gave way to plate armor. It is still used in the East.

Chain Pump. Pump having a chain to which buckets are attached, whereby water is drawn up through a tube in which the chain works.

Chain Riveting. Rivets placed opposite to each other in parallel rows, as distinguished from staggered riveting, where they are placed alternate; it is not an advantageous arrangement when the riveted piece is subject to tension.

Chain-Shot. Two shot linked together by a chain 8 or 10 inches long; formerly used on naval vessels to destroy the sails or rigging of the enemy's vessels.

Chair. Cast-iron support placed under the ends of the rails on a track. In the U. S. railroad chairs are now but little used, the rails being supported by wooden cross-ties and connected by fish-plate or angle-bar joints.

Chalarothoraca. Order of *Heliozoa*, in which the envelope consists of loosely-aggregated silex spicules.

Chalaza. Base of the ovule, or seed, of flowering plants.

Chalazæ. Whitish, twisted strings in each end of the hen's egg, floating in the white and proceeding from the yolk. They serve to steady the yolk.

Chalcanthite. $CuSO_4+5aq$. Copper vitriol as it occurs in nature.

Chalcedon. City of Bithynia, opposite Byzantium; colonized from Megara 685 B.C., birthplace of Xenocrates; taken by Romans 74 B.C., and a free city under their rule; plundered by Goths 259; taken by Chosroes 616 and by Turks 1338. The 4th general council was held here 451, and condemned the Monophysites.

Chalcedony. Broadly, all uncrystallized varieties of quartz, or quartz mixed with opal, that are transparent or translucent and somewhat waxy in luster; commonly the white or delicately brown or blue kinds.

Chalchihuitl. Greenish or bluish stone found in New Mexico and Arizona, and prized by Indians; variety of turquois, jadeite, or emerald.

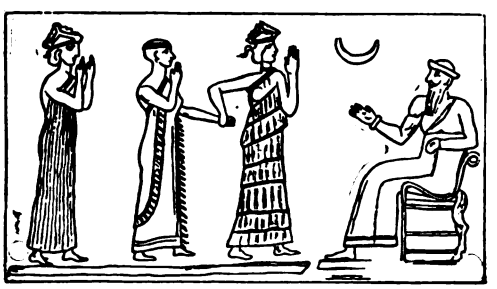
Chalcis. City of Eubœa, colonized from Athens; anciently of strategic and commercial importance; held by the Venetians 1205–1470, when the Turks took it. Also, two cities of Syria.

Chalcocite, or COPPER GLANCE. Cu_2S. Mineral of copper and sulphur, with 7± 8 per cent copper.

Chalcondylas, DEMETRIUS, 1428–1500. Greek teacher in Italy from ab. 1450; ed. Homer, Isocrates and Suidas.

Chalcopyrite, or COPPER PYRITES. $CuFeS_2$. Mineral containing copper, sulphur and iron, in nearly equal proportions. One of the most abundant of the copper ores.

Chaldean Art. The name of s. e. Chaldea or Babylonia was Accad or Akkad, as distinct from Sumir, the n. w. portion. There was also a Chaldean city of Accad. The adjective Accadian therefore signifies the oldest known and non-Semitic Babylonian (Chaldean) population and culture. Recent discoveries of Prof. Terrien Delacoupérie and of Rev. C. J. Ball point to this population as having had an influence on Chinese culture, or even tend to show that the latter is an offshoot from it. The researches of the former point rather to relations of culture (see *Oriental and Babylonian Record*), while those of Ball tend to establish an identity of language. The Accadian language is being deciphered with great difficulty by means of Assyrian word-lists (dictionaries giving Accadian equivalents), preserved on the baked-clay tablets which served as records in Assyria. The CUNEIFORM CHARACTERS (q.v.) of the Assyrian inscriptions are inherited from the Accadian, although the languages are different. The same holds of the culture at large, as regards origins at least. The distinction lies in language and in race, the Assyrians being Semitic. The remains of this old Chaldean culture are scanty, consisting mainly of enormous mounds of brick construction (sun-dried), so degraded, and so ancient even as ruins, that no outlines or plans can be made out. Names of kings inscribed on these bricks are however deciphered. Many of these mounds are ruins of temples which had a general resemblance to the form of the Tower of Babel as described in Genesis. The Chaldean cylinder-seals are also an important



Signet cylinder of King Urukh.

field of antiquarian study. These were talismanic roller-shaped signets of hard and semi-precious stones, used by the owner to place his sign on the damp inscribed clay tablet before it was baked. Many of these tablets of the Assyrian period are in the N. Y. Metropolitan Museum of Art, as well as a large collection of cylinder-seals, some of them old Chaldean or Accadian. These cylinders are inscribed with cuneiform characters, generally giving the name of the owner, with figures of deities and with mythologic scenes. The most important recent discoveries of Accadian remains are those of the French Consul De Sarzec and of the American exploring expedition now working for the museum of Univ. Pa. De Sarzec's excavations at Tello, whose results have been recently placed in the Louvre, discovered diorite statues, both sitting and standing, of remarkably fine execution, supposed to date ab. 3,800 B.C. There is a gap of about 2,900 years between these works and the oldest works known of Assyrian art. This shows the labor which remains to be done for archæology in the Tigris-Euphrates valley and the very limited extent of present knowledge and excavations. See ASSYRIAN ART.

Chaldeans. Semitic inhabitants of s. Mesopotamia; Babylonians. Abraham emigrated from "Ur of the Chaldees."

Chaldee Language. Usual name of that form of Aramean, or Eastern Semitic, used in parts of Ezra and Daniel.

Chalice. Cup used in the Eucharist.

Chalk. $CaCO_3$. Carbonate of lime. White, earthy limestone forming the uppermost of the Mesozoic strata in Europe. No true chalk occurs in N. America, though some strata closely resembling it have been reported from Texas. Chalk consists of minute foraminiferal shells, some of which are perhaps identical with forms now living in the N. Atlantic. Chalk comes mainly from England; "French chalk" is a variety of talc.

Challenge. (1) Words or signs conveying an invitation to engage in a fight; an offense at common-law and generally by statute. (2) Formal objection to a voter, the grounds and manner of which are regulated by statute. (3) Formal objection to a jury panel or to an individual juror or judge, also regulated by statute. Challenge to fight a duel is a military offense in the U. S. army service, which by the 26th Article of War is punishable with dismission if the offender be an officer, and, if a soldier, by corporal punishment.

Challenge. Demand of a sentinel upon halting a person approaching his beat or post, until he be recognized as having authority to pass. Challenge to a member of a military court is the right conferred upon the accused about to be tried, to object to a member of the court-martial.

Challenger Expedition. Undertaken by the British Government 1872–76, for the scientific exploration of the Atlantic, Pacific and Southern Oceans. The vessel cruised over 68,900 nautical m., and made observations at 362 stations. The *Reports* were pub. in 37 vols., 1880–89.

Challis, JAMES, 1803–1882. English astronomer, prof. Cambridge 1836.

Challoner, RICHARD, D.D., 1691–1781. English R. C. Bp. of Debra *in partibus*, 1741, *Ch. History*, 1737; *Garden of the Soul*; *Britannia Sancta*, 1745.

Chalmers, ALEXANDER, 1759–1834. Scottish compiler. *Biographical Dictionary*, 32 vols., 1812–17.

Chalmers, GEORGE, 1742–1825. Scottish antiquary. *Caledonia*, 3 vols., 1807–10–24.

Chalmers, GEORGE PAUL, 1833–1878. Scottish portrait and landscape painter.

Chalmers, THOMAS, D.D., D.C.L., 1780–1847. Scottish preacher of highest rank; prof. St. Andrew's 1823; Edinburgh 1828; chief founder of the Free Ch. 1843; author of a plan of charity organization practiced in his (St. John's) Ch. in Glasgow 1819–23, and since generally adopted. The fame of his eloquence spread through western Christendom, and is perhaps best supported by his *Astronomical Discourses*, 1817. His works fill 34 vols., 1836–49.

Châlons-sur-Marne. Ancient city of n. e. France. Here Aurelian defeated Tetricus, the last of the "Thirty Tyrants," 274, and the Romans and Visigoths overcame Attila 451. It was a camp of instruction 1856–70. Pop., 1891, 25,863.

Châlon-sur-Saône. Town of e. France, 80 m. n. of Lyons, capital of Burgundy in 6th century. Pop., 1891, 24,686.

Chalybæus, HEINRICH MORITZ, 1796–1862. Prof. Kiel 1839–52. *Hist. Speculative Philosophy*, 1848, tr. 1854; *Ethics*, 1850.

Chalybeate Waters. Containing iron. Schwalbach Spring, Nassau, contains 6.9 grs. carbonate of iron. Other Chalybeate springs from 2 to 8 grs.

Chalybes. People mentioned by ancient writers as dwelling on the s. shore of the Black Sea and in the mountainous regions of Armenia and Mesopotamia. They were workers in iron, and are sometimes identified with the Chaldeans.

Chalybite. $FeCO_3$. Ferrous carbonate; also called siderite and spathic iron ore.

Cham. Pseudonym of Amédée de Noé, 1819–1879. Parisian caricaturist.

Chamæleon. See VERMILINGUIA.

Chamber. To give the cartridge in smooth bore guns a more manageable form in loading, and to make the surface of the bore at the seat of the charge a minimum, as regards the volume, the diameter of the bore at this place was reduced to form a chamber: the forms most in use were cylindrical in guns firing small charges, such as mortars, and conical, called the Gomer chamber after its inventor, in guns firing large charges.

Chamber. That part of a military mine designed to receive the charge. Its center is placed on a level with the

mine-gallery floor and either on one side or at the extremity of the gallery.

Chamber. In coal mining, a working-place where coal is excavated between pillars. See BORD and BREAST.

Chamber, IMPERIAL. Court instituted 1495 to decide questions arising between the independent members of the German Empire. It ceased with the Empire 1806.

Chambered Organ. Chamber in the center dorsal plate of Crinoids, which is inclosed in nervous tissue and sends prolongations down the stalk and along the axes of the arms. The nerves that accompany it are motor. The nerve strands of the ambulacral groove are perhaps mainly sensory.

Chamberlain. Officer, usually under a monarch; originally treasurer. His duties are chiefly domestic and social.

Chamberlain, DANIEL HENRY, b. 1835. Attorney-gen. of S. C. 1868–72; gov. 1875–76.

Chamberlain, JOSEPH, b. 1836. Mayor of Birmingham 1873–76; M. P. since 1876; cabinet minister under Gladstone 1880 and 1886; Liberal-Unionist since 1886.

Chamberlain, JOSHUA LAWRENCE, LL.D., b. 1828. General in the Civil War; Gov. of Me. 1867–71; prof. Bowdoin Coll. from 1856, and its pres. 1871–83.

Chamberlin, THOMAS CROWDER, LL.D., b. 1843. Prof. of Geology Univ. Chicago; chief of the Glacial Division of the U. S. Geological Survey; formerly pres. Univ. Wis. and State Geologist. *Reports on Geology of Wisconsin*, on the *Kettle Moraine*, and numerous papers on glacial geology.

Chamber Music. Instrumental compositions in the severe forms, trios, quartets, quintets, etc. Formerly the term signified all music not intended for ch. or theater; royalty being the chief promoter of music, concerts took place in the king's chamber, the musicians being servants in the royal household.

Chambers. Place where judicial functions are exercised which are not required to be performed in open court. Whether an act is done "at chambers," depends on its nature, not on the locality.

Chambers, JOHN DAVID, b. 1805. English translator of Latin hymns.

Chambers, ROBERT, LL.D., 1802–1871. Scottish publisher, author of a paper on *Glacial Phenomena in Scotland and Parts of England*, and of a work on ancient sea-margins. His *Vestiges of Creation*, 1844, long anonymous for prudential reasons, but now acknowledged, was the first popular account of Lamark's doctrine of development, and its publication formed an epoch in the history of evolution.—His brother, WILLIAM, LL.D., 1800–1883, his partner from 1832, wrote several books. The firm pub. many useful works, among them *Chambers' Journal*, *Miscellany*, and *Encyclopedia*.

Chambers, SIR WILLIAM, 1726–1796. English architect, designer of Somerset House, "the greatest architectural work of the reign of George III."

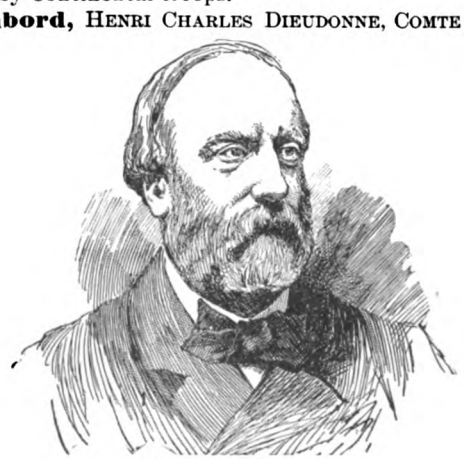
Chambersburg. Capital of Franklin co., Pa.; burned by Confederates under McCausland, July 30, 1864. Pop., 1890, 7,863.

Chambers of Commerce. See BOARDS OF TRADE.

Chambertin. Red wine of Burgundy, famous as being the favorite of both Louis XIV. and Napoleon. The grape is grown on the hills of the Côte d'Or between Dijon and Chalons. See BURGUNDY WINES.

Chambly. Canadian fort, on Sorel River, captured Oct. 18, 1775, by Continental troops.

Chambord, HENRI CHARLES DIEUDONNE, COMTE DE, 1820–



Comte de Chambord.

1883. Son of the Duc de Berri, and grandson of Charles X., who abdicated in his favor July 1830, when Louis Philippe was the choice of the people. He held the obsolete views of his ancestors and maintained a mimic court. The Comte de Paris succeeded to his claims; he is the grandson of Louis Philippe, of the Orleans, the younger branch of the House of Bourbon.

Chambre Ardente. French court, 1535–1680. Chiefly occupied in sentencing heretics to the stake; most active under Henry II.

Chambre Introuvable. French Chamber of Deputies, July 1815–16; so called from its excessive monarchical zeal.

Chamfer. In architecture, cutting off the square corner of a beam, or working of it into a moulding.

Chamfer-Stop. Termination of a chamfer, either by a plain face, by the section of its moulding, or by a carved ornament.

Chameleon Mineral. Potassium manganate; so called because under certain conditions it changes from green to purple, and vice versa.

Chamfort, NICOLAS, 1741–1794. French writer, best in maxims and anecdotes. Though he joined the Jacobins, his bitter wit roused their enmity, and to escape the guillotine he committed suicide.

Chamier, FREDERIC, 1796–1870. English naval novelist. *Ben Brace*, 1836.

Chamisso, ADELBERT VON, 1781–1838. German lyric poet and novelist. *Peter Schlemihl*, 1813, tr. 1843.

Chamois. See ANTILOPIDÆ.

Chamomile. Plants of the genera *Anthemis* and *Matricaria* of the Composite family; mostly natives of the Old World. *Anthemis nobilis* produces the Chamomile flowers of commerce. —In medicine, used as a bitter tonic.

Chamomile, WILD. Herbs of the genus *Matricaria*, natural family *Compositæ*, natives of the northern hemisphere.

Chamouni, VALE OF. Alpine valley surrounded by Mont Blanc, Mont Breven, and the Aiguilles Rouges, celebrated for its wonderful beauty, famous in literature, and especially as inspiring Coleridge's *Hymn before Sunrise*.

Camomile (*Anthemis*).

Champagne Wine. This wine is produced in department of the Marne, mentioned below, good wine only in the prefectures of Rheims and Epernay. It is said to have been invented by Dom Perignon, the cellarman of the Benedictine monastery of Hautvillers, in 1688. It is a mixture or cuvée of wines. The grape juice is cleared in vats and then fermented in barrels. At Christmas it is drawn off and the mixture of different wines made in a large vat. Four-fifths of black grape wine is mixed with one-fifth white grape wine. This requires great skill, as the quality of the finished wine depends upon the selection of the wines. The wine is now placed in barrels and the fermentation continued. In four weeks the wine is drawn off and fined or clarified in barrels with isinglass. It is drawn off again to casks and again fined, after which it is bottled, in March or April, and the bottles placed horizontally in racks, there fermenting for eighteen months to three years. The sediment from the fermentation collects on the lower side, and at the close of the fermentation is removed by inclining the bottles, corks downward, and by turning them, causing the sediment to settle upon the cork. In two months this is accomplished, the sediment disgorged and the dosage of sugar in old wine, brandy or alcohol injected. This gives sweetness and, by fermentation, carbonic acid gas. Brut wine has no sugar introduced. Champagne contains from 14 to 15 per cent alcohol, 24 to 28 grs. sugar per oz., and acid equivalent to 4 to 5 grs. tartaric acid per oz. This acid is mostly malic with a little tartaric and acetic. Of the 80,000,000 bottles of wine produced annually in the Marne, only one-fourth is used for effervescing wine, the rest being mostly used for red wine and some for white. In the year ending April 1, 1895, there were sold for consumption in France 4,908,281 bottles, exported 16,129,374, and sold to merchants in the department 3,402,293, a total of 24,439,748 bottles. There remained in the hands of merchants of Champagne 108,531,393 bottles. The importation of Champagne into U. S. in 1894 was 3,189,156 bottles.

Champagne. Ancient province of France; part of the Frankish Empire. After ab. 1100 its dukes were vassals of the French kings. It came to the French crown by marriage 1284,

Champagne.

was united to France 1328, and was the scene of warfare 1792, 1814, and 1870. It is now divided into the departments of Ardennes, Marne, Upper Marne and Aube.

Champaigne, PHILIPPE DE, 1602–1674. Portrait painter of Flemish birth, prominent at Paris.

Champ de Mars. Open space in Paris on left bank of the Seine. The Franks held their assemblies here. It has been the scene of notable gatherings and festivals, and of several International Exhibitions, 1867, 1878, 1889.

Champerty. Maintaining a suit for one of the parties in consideration of a bargain for a share of his recovery. At common law, such a maintainer was liable to a criminal prosecution, and to a civil action for damages by the opposing litigant. The champertous bargain was unenforceable. In most of the U. S. it is neither a crime nor a tort.

Champfleury. See FLEURY, J. F. F. H.

Champion Hills. In Hinds co., Miss.; scene of a Union victory by Grant and McClernand, May 16, 1863.

Champion Lode. Largest and most persistent of several lodes that had a common origin.

Champlain, SAMUEL DE; 1567–1635. French explorer. He first visited Canada 1603, began the settlement of Quebec 1608, and was gov. 1612–28 and 1633–35. *Voyages to New France,* 1632.

Champlain, LAKE. Between N. Y. and Vt., projecting into Canada; drained into the St. Lawrence by Richelieu R. Area 488 sq. m.; elevation 101 ft. It was discovered by Champlain 1608, was the scene of Arnold's defeat Oct. 13, 1776, and of McDonough's naval victory near Plattsburgh Sept. 11, 1814.

Champlin, JAMES TIFT, D.D., 1811–1882. Prof. Waterville Coll., Me., 1841–57; pres. 1857–72; author of classical and other textbooks.

Champlin, JOHN DENISON, b. 1834. American editor of cyclopædias and juvenile books. *Painters and Painting,* 1888; *Music and Musicians,* 1888.

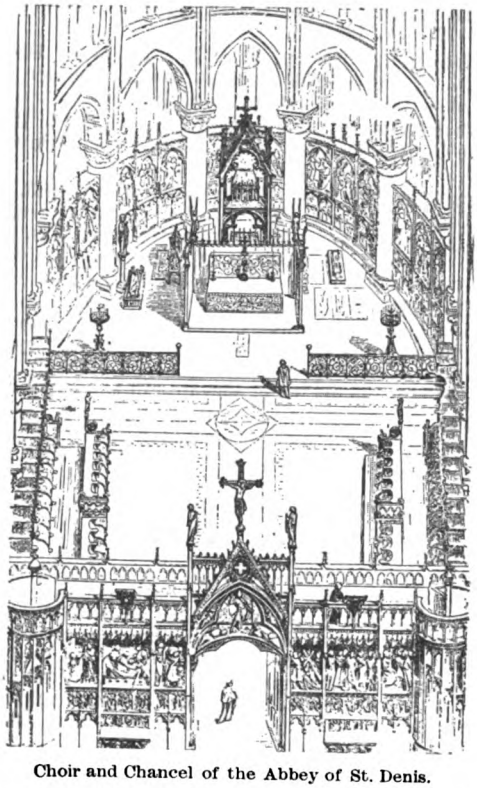
Champney, JAMES WELLS, b. 1843. American genre painter, working largely in pastel.

Champollion, JEAN FRANCOIS, 1791–1832. French Egyptologist, famed for deciphering the hieroglyphics in 1821. In this we separate his reading of the characters in which he had been to some extent preceded by the English Dr. Young, from his wholly original discovery that the language used was the parent of the Coptic; hence, through the study of Coptic, the possibility of reading old Egyptian. *Grammaire Egyptienne,* 3 vols., 1836–41; *Monuments de l'Egyote et de la Nubie,* 5 vols., 1835–45.

Champollion-Figeac, JEAN JACQUES, 1778–1867. French antiquary and librarian of Fontainebleau under Napoleon III. *Chronicles of the Greek Kings of Egypt,* 1819; *Treatise on Archæology,* 1843.

Chance. Causeless or, more properly, undesigned connections between phenomena; opposed to the notion of purpose, but not to cause. See PROBABILITY.

Chancel. Railed space surrounding the altar; also called



Choir and Chancel of the Abbey of St. Denis.

Sanctuary; much more jealously secluded from the laity in the Eastern than in the Western Ch.

Chancellor. High officer of a State, university, or other organization, with functions varied and partly legal. The British Lord Chancellor is the most prominent surviving example.

Chancellorsville. In Spottsylvania co., Va. Here, May 2–5, 1863, the Union forces under Hooker were defeated, losing 17,000 out of 132,000 men; Lee lost 13,000 out of ab. 60,000.

Chancery, COURT OF. Named from the chancellor or presiding judge. It originated in the inability of the common law courts to do complete justice in many cases, and developed into the most important judicial tribunal in England. See EQUITY.

Chancre. Ulcerative process of the skin or mucous membranes, which is the initial lesion of syphilis, and which may appear at any time between ten days and two months after exposure or inoculation. It is painless, has a hard parchment-like base, and its secretion gives rise to a similar process when inoculated upon another, but not upon the individual from whom it has been taken. The neighboring glands usually enlarge, are painless, and do not as a rule suppurate. See SYPHILIS.

Chancroid. Ulcer, contracted by impure sexual congress, which discharges pus freely, which latter, inoculated upon the person from whom it is, or upon another, gives rise to a similar sore. The neighboring glands enlarge as a rule, are painful, and generally suppurate. No constitutional symptoms follow this disease, and it is only dangerous on account of the amount of tissue which may be destroyed if it is neglected.

Chandler, CHARLES FREDERICK, M.D., LL.D., b. 1836. Prof. of Chemistry, Union Coll. 1857; Columbia School of Mines 1864; Coll. Physicians and Surgeons, N. Y., 1872; Columbia Coll. 1877; College Pharmacy, N. Y., 1866; Pres. N. Y. Board of Health 1873–83; ed. with his brother, *American Chemist,* 1870–77.—His brother, WILLIAM HENRY, Ph.D., b. 1841, has been prof. at

Lehigh Univ. since 1871, and director of the Univ. Library since 1879.

Chandler, JOHN, 1806–1876. English translator of Latin hymns. His versions, 1837, were nearly the first to appear on a large scale, and are in extensive use.

Chandler, SETH C., b. 1845. American astronomer; invented the almucantar and catalogued the variable stars.

Chandler, WILLIAM EATON, b. 1835. U. S. Sec. Navy 1882–85; U. S. Senator from N. H. since 1887.

Chandler, ZACHARIAH, 1813–1879. U. S. Senator from Mich. 1857–75; Sec. Interior 1875–77.

Chang and Eng, 1811–1874. Siamese twins, inseparably joined by nature; exhibited in U. S. and Europe 1829–54. They married sisters in N. C.

Changarnier, NICOLAS ANNE THEODULE, 1793–1877. French general, in Algeria 1830–48, in exile 1851–70.

Changchow. City of China, on a branch of the Lung Kiang. It has extensive silk manufactures. Pop. ab. 800,000.

Change of State. Passage of a body from one of the three states of matter to another; *i.e.*, from the solid to the liquid, or from the liquid to the gaseous. It is always accompanied by thermal changes which vary in different cases and are dependent upon the nature of the substance under consideration. *E.g.*, water is formed from ice by the expenditure of 79.2 calories of heat for each kilogram. This is called the heat of liquefaction of water. The heat of vaporization in the case of steam is 537 calories.

Changing-House. Place where miners change their clothing when going to work underground.

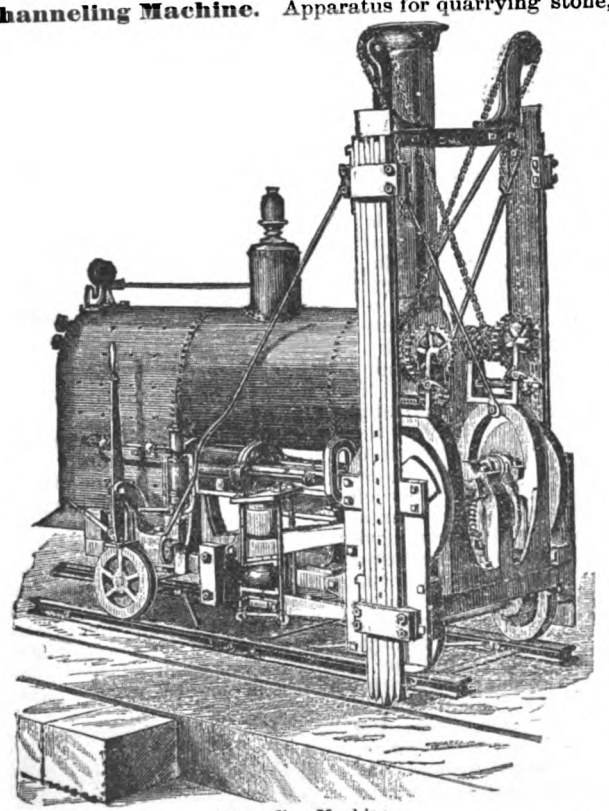
Chank Shell. Favorite ornament of the Hindoo women, worn as bangles, etc. Enormous prices are paid for some varieties which come from the Indian and Pacific Oceans. They are *Turbinella* species of mollusks.

Chanler, MRS. AMELIE (RIVES), b. 1863, m. 1888. Virginia novelist. *The Quick or the Dead?*. 1888; *Barbara Dering*, 1892; also dramas, *Herod*, 1889; *Athelwold*, 1893.

Channel. Bed of a canal or trough for conveying water. The most economic proportion for the rectangular cross-section of a channel is when its width is double its depth.

Channel, ENGLISH. Between England and France; in width from 21 to 140 m.

Channeling Machine. Apparatus for quarrying stone,



Channeling Machine.

consisting of vertical chisels which cut a narrow channel several feet in length and depth around the portions to be removed; used in excavating rock to form a canal or railroad cut; of recent introduction, but found very efficient when large masses of rock are to be excavated.

Channel Iron. Rolled wrought iron or steel section consisting of two flanges connected by a web on one side; used in bridges and structural work. The heaviest channels are 15 in. in depth and weigh ab. 200 lbs. per linear yard.

Channel Islands. Guernsey, Jersey, Alderney, Sark, and others, n. w. of France; belonging to England since the Norman conquest. Total area 65 sq. m.; pop., 1891, 92,272.

Channels, OFFICIAL. Those through which official correspondence is transmitted in the military service. Communications from an inferior to a superior, or *vice versa*, pass through the intermediate commanders. Official correspondence passes through the adjutant-gen. or adjutant of the command; chiefs of bureaus of the War Department correspond directly with their subordinate officers upon matters relating to the duties of the bureau.

Channel Tunnel. Partially executed work 23 m. in length between Dover and Sangatte near Calais, to avoid the horrors of the Channel passage. Begun in 1876 it has been stopped on account of possible military complications, only one-tenth being completed. It is estimated to cost $20,000,000.

Channing, WILLIAM ELLERY, D.D., 1780–1842. Pastor in Boston from 1803; most eminent pulpit orator of his school, and most saintly and revered of American Unitarians. Of that body he led the "orthodox" or "evangelical" wing, as Theodore Parker did the radical side. He wrote little beyond sermons, but his influence was wide and deep.—His *Memoir*, 3 vols., 1848, is by his nephew, WILLIAM HENRY, 1810–1884. —Another nephew, named from him, b. 1818, pub. 5 vols. of verse, and *Thoreau, the Poet-Naturalist*, 1873.

Chansar. East Indian game known as *pachisi*, played with three dice instead of cowrie shells. Two kinds of dice are used, consisting of square prisms of bone or ivory ab. 2 in. long, or similar prisms, much smaller and sharpened at both ends. These dice are marked on the sides with dots. "one," "two," "six," and "five," and are rolled from the hand. The game is of great antiquity, descending from the divinatory arrow games. It is one of the steps in the evolution of Chess.

Chanson de Roland. Anglo-Norman epic ab. 1090. author unknown; "greatest of Old French poems."

Chansons de Gestes. Narrative poems of 11th century, on historical subjects; earliest form of French literature.

Chant. Melodic formula for the recitation of psalms and canticles; formerly consisting of three parts, Intonation, Mediation, and Termination, or closing cadence, separated by recitations on the dominant of the mode. The source of a chant is indicated by adjectives like Gregorian, Anglican, Gallican, etc. This form of Ch. music was developed by Ambrose and Gregory.

Chantilly. Estate and castle 23 miles n. n. e. of Paris, famed as the magnificent residence of the Princes of Condé where royalty was frequently entertained. Demolished during the French Revolution, it was afterward bought and rebuilt by the Duc d'Aumale, who turned it into an art-palace and presented it to the French nation in 1886.

Chantilly. In Fairfax co., Va.; scene of a battle, Sept. 1, 1862. Union loss 1,300; Confederate, 800.

Chantrey, SIR FRANCIS LEGATT, 1781–1841. English sculptor, R. A. 1818, knighted 1837.

Chantry. Small chapel forming part of a church, to provide masses for the dead. Originally a memorial containing the tomb of the founder.

Chanute, OCTAVE, b. 1832. French-American civil engineer and writer on railroad construction and on aeronautics. *Aerial Navigation*, 1893.

Chanzy, ANTOINE EUGENE ALFRED, 1823–1883. French general commanding 2d Army of the Loire Dec. 1870; defeated at Le Mons Jan. 1871; gov. of Algeria 1873–79; life senator 1875; ambassador to Russia 1879–81.

Chaos. In mythology the infinite void which existed before the creation of the world, from which arose the gods, men, and all things.

Chap-Books. Small volumes sold by peddlers, prevalent in Europe ab. 1600–1800.

Chapeau en fer. French term, equivalent to the English gossan or gozzan, ferruginous quartz.

Chapel. Smaller and subordinate house of worship, attached to and dependent on a parish church; or one used by dissenters from an established Ch.; also an apartment in a public or private building devoted exclusively to worship.

Chapelain, JEAN, 1595–1674. French epic and lyric poet, satirized by Boileau. *La Pucelle*, 1656.

Chapin, EDWIN HUBBELL, D.D., LL.D., 1814–1880. Universalist pastor in N. Y. from 1848; one of the most eloquent preachers and lecturers of his time.

Chaplain. Clergyman attached to an army post or regiment, to a vessel, jail, college, or nobleman's household. In the U. S. Army he has the rank of captain of infantry. The law provides for 30 post chaplains and 4 chaplains for the 4 colored regiments; viz., the 9th and 10th of cavalry, and the 24th and 25th of infantry.

Chaplin, CHARLES JOSHUA, 1825–1891. French portrait painter and decorator, of English parentage.

Chapman, ALVAN WENTWORTH, M.D., b. 1809. American botanist. *Flora of the Southern U. S.*, 1860.

Chapman, GEORGE, 1557–1634. Eng. dramatist. More successful in translating Homer. *Iliad*, 1598–1611; *Odyssey*, 1614–15.

Chapman, JOHN GADSBY, 1808–1889. American painter who spent much time in Italy. His *Baptism of Pocahontas* is in the Capitol at Washington.

Chapone, MRS. HESTER (MULSO), 1727–1801, m. 1760. Eng. author. *Improvement of the Mind*, 1772; Works, 4 v., 1807.

Chappe, CLAUDE, 1760–1805. French inventor of a telegraph 1792.

Chapped Hands. Inflammation or chilblain, caused by exposure to cold; sometimes eczema.

Chappell, WILLIAM, 1809–1888. English music publisher; ed. *Popular Music of Olden Time*, 1855–59. *Hist. Music*, 1874.

Chapsal, CHARLES PIERRE, 1788–1858. Author, with F. Noel, of a most successful French grammar, 1823.

Chaptal, JEAN ANTOINE, COMTE DE CHANTELOUP, 1756–1832.

Jean Antoine Chaptal.

French chemist and manufacturer; Minister of the Interior 1801–4; ennobled 1811. *Chemistry Applied to the Arts*, 1806.

Chapter-House. Room or building in which the governing body of a cathedral or abbey-church transacted the business of the corporation. In a cathedral it was often of elaborate design and costly workmanship.

Chapu, HENRI, 1833–1891. French sculptor. His *Mercury* and *Joan of Arc* are in the Louvre.

Chapultepec. Mexican fort, taken Sept. 13, 1847, by the Americans under Gen. Scott, who entered the city of Mexico the next day.

Chapultepec.

Char. See SALVELINUS.

Characeæ. Class of plants of aquatic habit, placed in the system between Mosses and Algæ, usually regarded as belonging to the sub-kingdom *Thallophyta*. Many species give off sulphuretted hydrogen in decaying and are very offensive. They extract calcium carbonate from the water and become covered with it as an incrustation. Commonly called brittleworts or stoneworts.

Characin. Substance contained in the *Characeæ* and in certain *Algæ* and *Palmellaceæ*, which has an extremely fetid odor, resembling that of sulphuretted hydrogen.

Character. Nature of a man, looked upon as a composite of moral qualities of special kinds and relative strength, and as the result of the whole series of influences and training to which he has been subjected.

Character. In Biology, features of an organism or group of organisms which distinguish it from others.

Characteristic. Integral part of a logarithm. In common logarithms, adding one to the characteristic multiplies the number corresponding to the logarithm by ten: the characteristic thus determines the order of the number in the general scale.

Charade. Puzzle which divides a word into syllables and indicates each ("my first," etc.), and then the whole, by some relation or resemblance. This may be dramatized in acted charades.

Charadriidæ (PLOVERS). Family of *Grallatores*, having thick head, short neck, and hard edged beak of medium length, long legs with toes united at bases, the hind toe small and above the ground-level, or wanting. The wings are well developed.

Charadromorphæ. See GRALLÆ.

Charbon. The disease ANTHRAX (q.v.).

Charcoal. Made by heating wood in a closed vessel without admittance of air, so that the water and volatile matters it contains are driven off, leaving the fixed carbon and ash. This may be done in large ovens or retorts and the products of the distillation condensed; or else the wood is charred in an open pile, the heat developed by the complete combustion of part of the wood being used to char the rest. The latter method is the original one used in the forests by the charcoal burners, and is conducted as follows: a level piece of ground is selected in a sheltered spot, and in the center a large stake is driven. Around this the pieces of wood in ab. 4-foot lengths are piled, either on end or flat, the spaces between the large pieces being filled with small branches, twigs, etc. (fig. 1). A pile may be 20 to 60 ft. in diameter, and 5 to 12 ft. high. The outside is covered with wet leaves and earth. The stake in the center is then pulled out, leaving a chimney, into which some shavings and light wood are dropped and fired. Openings to let in air are now made around the outside edge of the pile against the ground.

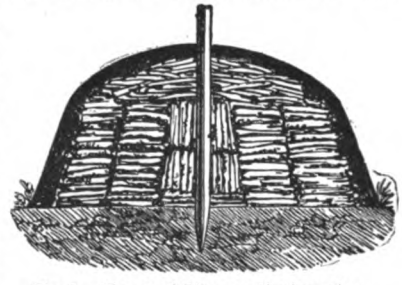


Fig. 1.—Charcoal Pile; vertical section.

The fire burns very slowly, at first giving off a thin, yellow smoke, which consists of the volatile matter from the wood. After several days the smoke becomes gray, and then the openings admitting air are closed and the pile left to burn slowly with a very small admission of air, such as leaks in through the cracks in the outer covering. The pile shrinks as the wood chars, and needs continual watching to prevent it firing and being entirely consumed. Toward the end of the charring the openings around the edge are again opened to draw the draft that way and char the outer layers of wood. Small piles are carbonized in 6 to 14 days; large piles require a month or more. Wood gives 15 to 25 per cent of its weight of charcoal, according to the slowness with which it is charred, and the care with which the pile is extinguished. Sometimes the pile is made rectangular, with stakes around the sides to keep it in shape (fig. 2). These methods of charring, while cheap and capable of being conducted out in the forest, have the disadvantage of allowing all the volatile matter to escape. In the U. S. charcoal-burn-

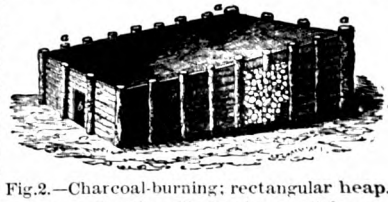


Fig. 2.—Charcoal-burning; rectangular heap.

ing is done in kilns connected with condensers. The ovens are either rectangular, cylindrical, or conical, with a capacity of 50 to 100 cords of wood, yielding 1,000 to 4,000 bushels of charcoal. The wood is fired and part allowed to burn in order to char the rest, as in an open pile, but the gases coming off are all condensed. Both rectangular and cylindrical kilns are hard to keep air-tight, and have been largely displaced by the conical one (fig. 3). Sometimes the retorts are made small and the heat applied from without, thus allowing a more perfect condensation of the volatile matters, but producing an inferior quality of charcoal. In this case, the gases coming from the condensers are burnt to heat the retorts. The volatile matters condensed contain tar, pyroligneous acid, naphtha, wood spirits, acetic acid, and ammonia salts, and are often of more value than the charcoal obtained.

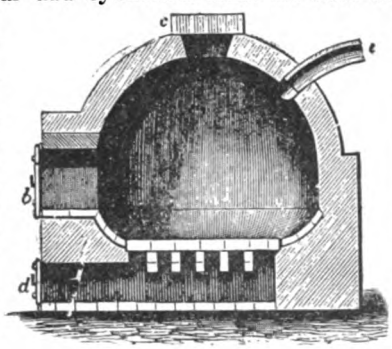


Fig. 3.—Charcoal Kiln; vertical section.

Charcoal is very light because of the porous structure, but its density in powder is 1½ to 2. Light woods give the lightest charcoal. The chemical composition is 90 to 95 per cent of carbon and 5 to 10 of ash, when fresh, but it can absorb 10 to 20 per cent of moisture on standing in the air. Practical use has shown that an equal volume of hard charcoal produces a greater heat than soft coal, or, that charcoal is equal to about 1½ times its volume of soft coal in heating power; also that it is 3 to 4 times that of an equal weight of wood. In evaporative effect, charcoal will turn into steam 8 to 12 times its own weight of water.

When freshly burned and finely powdered, it is used to relieve accumulations of gas in the stomach and to correct the odor arising from offensive wounds, being incorporated in poultices or placed in small bags which are loosely packed around the wound.

In the powdered state it is used for the manufacture of filters. It absorbs gases and coloring matter, and is used for the purification of alcoholic liquors, and as a disinfectant.

Charcot, JEAN MARTIN, 1825–1893. French physician, writer and investigator of nervous diseases, hypnotism, metallopathy and hysterical diseases.

Chardin, SIR JOHN, 1643–1713. French traveler, resident in London from 1681. *Persia and the E. Indies*, 1686–1711.

Chareæ. Order of *Characeæ*.

Chares. Greek sculptor of the Rhodian Colossus, ab. 300 B.C.

Chares. Greek historical writer, from Mytilene; employed by Alexander ab. 320 B.C. Fragments of his book remain.

Charge. (1) Obligation put upon property or a person, as by a testator upon land which he wills, or upon a devisee. (2) Accusation of wrong-doing: in some jurisdictions confined to a formal, legal accusation by complaint, or indictment. (3) Instructions by a judge to a jury as to the rules of law which should govern them in deciding a case.

Charge. Amount of explosive compound required to produce the intended effect in military mining. The charge coefficient is a constant determined for each kind of explosive by experiment. It is obtained by dividing the weight of the charge which produces a maximum crater by the square of the radius of explosion.

Chargé d'Affaires. Diplomatist subordinate to an ambassador, and sometimes taking his place.

Chariot. Ancient two-wheeled, poled vehicle, curved in front and open behind, and with a rail or dashboard of corresponding shape. It was adapted for standing; drawn by two or more horses. The only surviving example is that found in a Theban tomb ab. 1400 B C., and now in Florence, but pictures of such vehicles are common in Egyptian, Assyrian, Greek and Roman reliefs and paintings. There is also a marble chariot and pair in the Vatican. They were used mainly for war and for racing. The Celtic nations used them armed with scythes. See BIGA.

Charities, PUBLIC. Many of the States have Boards of Charities, who have charge of the State hospitals and who also recommend the State contributions to incorporated charities. Counties, cities, etc., also have commissioners of charity, who have charge of public hospitals and the poor-houses, and who also distribute aid to needy persons.

Charity. Gift to a general public use, which extends to the poor as well as to the rich. It will be sustained and protected by the courts if consistent with local laws, provided it is specific and the intention of the donor can be effectuated.

Charity. Love for mankind or individuals, as it determines the will toward benefiting them.

Charity Organization Society. This form of charity was inaugurated in London in 1869, and has extended over Great Britain and the U. S. Its object is to improve the condition of the poor, by investigation of the cases, suppressing professional begging, and securing co-operation among the charitable organizations and individuals.

Charity, SISTERS OF. Order founded 1629 by Vincent de Paul and Mme. Legras; confirmed by the pope 1668; devoted to benevolent works, and universally esteemed.

Charivari. Noisy and derisive demonstration common in France in past ages, usually against widows who remarried; surviving in the U. S. as "Callithumpian serenade," "shiveree" or "skimmelton."

Charlemagne, or CHARLES THE GREAT, 742–814. Son of Pepin the Short; ruler of the Franks from 772, founder of the Holy Roman Empire. He waged incessant wars with Saracens, Saxons and Lombards, promoted religion, learning, agriculture, commerce and the arts, and was crowned at Rome Dec. 25, 800. His empire extended from the Ebro to the Elbe; was securely founded, valiantly defended, and sagaciously governed; it aimed to fuse the Latin and Teutonic elements of w. Europe by aid of the Church.

Charleroi. Town of Belgium, besieged by the Prince of Orange 1672 and 1677; taken by the French 1693 and 1794. Many battles were fought near it. Pop., 1891, 22,551. See FLEURUS.

Charles I. (STUART), 1600–1649. King of England 1625; son of James I. His exalted views of the royal prerogative involved him in a contest with Parliament; his arbitrary taxation, religious persecution, and constant duplicity, caused civil war; he was defeated, tried and beheaded as a "tyrant, traitor and murderer" by the Independents, who through the army had gained supremacy. His private virtues were obscured by his public vices; he was the victim of sincere, incorrigible, and fanatical devotion to theories which, largely by his means, were proved untenable.

Charles I. of England.

Charles II. (STUART), 1630–1685. King of England 1660; son of Charles I.; in exile 1645; crowned in Scotland 1651; defeated by Cromwell at Dunbar and Worcester; restored 1660. He displayed, with more prudence, the absolutist tendencies of his family; truckled to France; and died in the R. C. faith. His court was notoriously dissolute.

Charles I., OF FRANCE, "THE BALD," 823–877. King 840. He paid tribute to the Normans 845 and 861, invaded Italy, and was crowned emperor by the pope 875.

Charles II., "THE FAT," 822–888. Son of Louis II.; emperor 881; King of Italy 880, and of France 885–887. He allowed the Normans to besiege Paris and was deposed by Arnulph, 887.

Charles III., "THE SIMPLE," 879–929. King of France 893. The throne was disputed by Eudes of Paris till 898.

Charles IV., "THE HANDSOME," 1294–1328. King of France 1322, last of the elder Capetians.

Charles V., "THE WISE," 1337–1380. King of France 1364; son of John II., and regent 1356–60. He recovered much territory from the English, and established Royal Library of Paris.—His son CHARLES VI., 1368-1422, became king 1380, and a lunatic 1392. His reign was full of wars and miseries.—That of his son, CHARLES VII., 1403–1461, was signalized by the victories of Jeanne d'Arc and the recovery of Normandy.—His grandson, CHARLES VIII., 1470–1498, the last of the Valois, came to the throne 1483, and began the Italian wars 1494.

Charles IX., 1550–1574. King of France 1560; son of Henry II. and Catharine de' Medici. His reign was disturbed by civil and religious wars, and is notorious for the massacre of St. Bartholomew 1572.

Charles X., 1757–1836. King of France 1824–30; forced to abdicate.—Also, a pretender, Cardinal Bourbon, set up 1589 by the League against Henry IV.

Charles IV., 1316–1378. German emperor from 1346; son of John of Bohemia. He issued the GOLDEN BULL (q.v.) 1356.

Charles V., 1500–1558. German emperor 1519; K. Spain 1516. He fought the Turks, deprived the French of most of their Italian conquests, and took Francis I. prisoner at Pavia 1525. His forces, under Charles of Bourbon, took Rome by storm and made the pope prisoner 1527. He overthrew the pirate Barbarossa at Tunis 1535, setting free 22,000 Christian slaves. His wars with the Protestant princes of Germany ended 1552; but his persecutions in the Low Countries prepared the way for the revolt which broke out under his son. He resigned Naples to Philip II. 1556, abdicated 1558, and entered a Spanish monastery. Though a sovereign of considerable ability and energy, his commanding position in history is due chiefly to the immense extent of his possessions; his policy was fatal either to the region where his power was greatest, or to the authority of his successors therein.

Charles VI., 1685–1740. German emperor from 1711; son of Leopold I. His claim to the Spanish crown led to a war of succession there 1703–13, and he engaged in others with the Turks. The Pragmatic Sanction, 1733, aimed to secure Austria to his daughter Maria Theresa.

Charles VII., 1697–1745. German emperor 1742; elector of Bavaria 1742. He was worsted in a contest for Austria, on behalf of his wife, a daughter of Joseph I.

Charles I., OF SPAIN. See CHARLES V. (of Germany).

Charles II., 1661–1700. King of Spain 1665. He made Philip, son of the Dauphin and grandson of Louis XIV., his successor, whence the war of the Spanish Succession.

Charles III., 1716–1788. King of Spain 1759; son of Philip V.; a wise and progressive ruler.—His son, CHARLES IV., 1748–1819, king 1788–1808, a fatuous monarch, was the tool and victim of his favorite Godoy, and later of Napoleon.

Charles IX., 1550–1611. King of Sweden 1604. As regent 1592–94, and later as viceroy, he promoted Lutheranism, which contributed to the deposition of his nephew Sigismund, who was king also of Poland. He ruled well, and founded the Univ. of Gothenburg.

Charles X. (GUSTAVUS), 1622–1660. King of Sweden 1654; grandson of Gustavus Adolphus. He defeated the Poles and Danes.—His son, CHARLES XI., 1655–1697, reformed the finances and the forces, and founded the Univ. of Lund.—His son, CHARLES XII., 1682–1718, "a brilliant madman," warred with Denmark, Russia, and Poland, whose king he deposed; was defeated by Peter the Great at Pultowa, July 8, 1709; was in Turkey till 1714; was attacked by Russia, Prussia, and Denmark; formed a wild plot to restore the Stuarts in Scotland; and fell while invading Norway. With him ended the prominence of Sweden in the affairs of Europe.

Charles XIII., 1748–1818. King of Sweden, 1809.

Charles XIV. (JEAN BAPTISTE JULES BERNADOTTE), 1764–1844. French soldier, made a marshal by Napoleon 1804; elected crown prince of Sweden 1810; subjugated Norway 1814; commanded the allied army in n. of Germany; succeeded Charles XIII. 1818.—His grandson CHARLES XV., 1826–1872, was king from 1859.

Charles I., OF ROUMANIA, b. 1839. A Hohenzollern; prince 1866, king 1881.

Charles, ARCHDUKE OF AUSTRIA, 1771–1847. Third son of Leopold II. As commander of the army of the Rhine 1796 and 1798 he defeated Moreau, Massena and Jourdan: effected a famous retreat from the Adige to Croatia 1805; won the battle of Aspern, May 21–22, 1809; was defeated at Wagram July 5–6. He wrote a work on *Strategy*, 1814.

Charles Albert, 1798–1849. King of Sardinia 1831; defeated by the Austrians at Novara March 1849; succeeded by his son, VICTOR EMMANUEL.

Charles d'Orleans, 1391–1465. French lyric poet, prisoner in England 1415–40; father of Louis XII.

Charles Edward, 1720–1788. Son of James Stuart, and grandson of James II. He entered Edinburgh Sept. 17, 1745, won a victory at Preston Pans Sept. 21, and advanced into England; was defeated at Culloden April 16, 1746, and escaped after many perils. His later life showed him unfit to rule.

Charles Martel, 689–741. Duke of Austrasia; mayor of the palace 714, with virtually royal power. He laid the foundation of the French kingdom, and won a decisive victory near Tours over the Saracens 732.

Charles, "THE BOLD," 1433–1477. Duke of Burgundy 1467; a rash and fierce warrior, defeated by the Swiss at Morat 1476, and killed at Nancy. His regal possessions brought him into conflict with Louis XI., who seized Burgundy on his death.

Charles, MRS. ELIZABETH (RUNDLE), b. 1826, m. 1851. English poet and novelist. *Three Wakings*, 1859. Her *Voice of Christian Life in Song*, 1858; includes some useful translations. Her *Schönberg-Cotta Family*, 1863; *Kitty Trevylvan*, 1864; *Draytons and Davenants*, 1866; *Victory of the Vanquished*, 1870, and other tales of religious history, have been highly valued.

Charles, JACQUES ALEXANDRE CESAR, 1746–1823. French electrician and aeronaut.

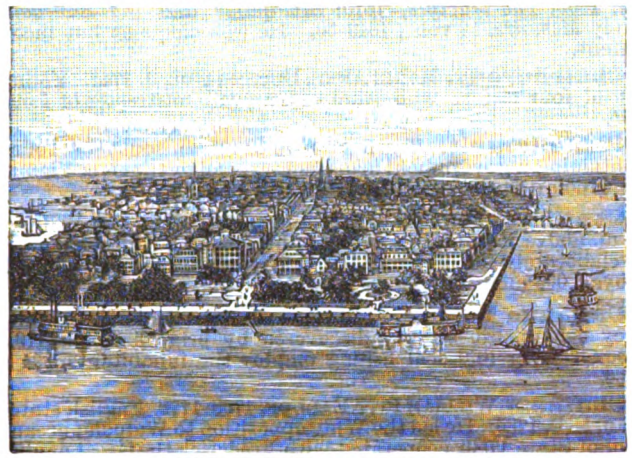
Charles, CAPE. S. point of eastern shore of Va., at entrance to Chesapeake Bay.

Charles' Law. "The volume of a given mass of gas under a constant pressure varies directly as the absolute temperature," or $Vp = CT$. Combining the laws of Boyle and Charles, we may write, $\frac{PV}{T} = R$; where R is constant for each gas and is called the "modulus" of that gas. Though discovered by J. A. C. Charles ab. 1787, it was not known to the world until after Dalton in 1801 and Gay Lussac in 1802 had independently discovered and announced the same law, which therefore frequently bears their names.

Charles XII. of Sweden.

Charleston. Capital of Charleston co., S. C.; a seaport and the largest city of the State. Its harbor is excellent; it has good railroad communications and some manufactures. Its principal industry is handling and shipping cotton. It was founded 1680, attacked by a British fleet 1776, taken May 12, 1780, and evacuated Dec. 14, 1782. The Civil War began here

with the firing on Fort Sumter April 12, 1861. A Federal fleet attacked the city April 1863, but the Confederates held it till



Charleston, South Carolina.

Feb. 19, 1865. It was much injured by an earthquake Aug. 31, 1886. Pop., 1890, 54,955, more than half colored.

Charleston (S. C.), COLLEGE OF. Founded 1785, reorganized 1838. It has 7 instructors, a fine Museum of Natural History, and an endowment of ab. $300,000.

Charleston. Capital of W. Va. and of Kanawha co.; on n. bank of Kanawha R. Pop., 1890, 6,742.

Charlestown. Suburb of Boston, Mass., annexed 1873. See BUNKER HILL.

Charlestown. Capital of Jefferson co., W. Va.; scene of John Brown's trial and execution, 1859. The Federal garrison here was captured Oct. 18, 1863. Pop., 1890, 2,287.

Charlatan. Empiric or quack-doctor who often added astrology, palmistry and legerdemain to his other means of imposing on vulgar credulity. Greek vase-paintings caricature Æsculapius as an itinerant charlatan, and in Rome fashionable mountebanks amassed enormous fortunes. In the Middle Ages, despite papal bulls and repressive laws, the evil grew.

Charlet, NICOLAS TOUSSAINT, 1792–1845. French painter, chiefly of battles.

Charlevoix, PIERRE FRANÇOIS XAVIER DE, 1682–1761. Jesuit traveler; teacher at Quebec 1705–9, and in France. In 1720–22 he went up the St. Lawrence and the Lakes, and down the Illinois and the Mississippi to the Gulf. *History of New France*, 1744, tr. 1865–72; also histories of Japan, St. Domingo and Paraguay.

Charlock. *Brassica sinapistrum.* Weed of the Mustard family, native of Europe, introduced into N. America.

Charlock, JOINTED. *Raphanus raphanistrum.* Weed of the Mustard family, native of Europe, introduced into N. America.

Charlotte. Capital of Mecklenburg co., N. C. Pop., 1890, 11,557.

Charlottenburg. Suburb of Berlin, on the Spree. It contains a royal palace and fine park. Pop., 1890, 76,873.

Charms. Verses in which spells were usually written, operating as magical cures in bodily and more especially mental diseases. They were also used to avert misfortune and counteract malignant influences.

Charon. Son of Erebus and Nox, represented as an old man who ferried the dead over Acheron.

Charon, ab. 470 B.C. Of Lampsacus; Greek writer on the Persians. Fragments remain.

Charrières, MME. STE. HYACINTHE DE, 1740–1805. French novelist. *Caliste*, 1786.

Charron, PIERRE, 1541–1603. French priest and philosopher. His three books *Of Wisdom*, 1601–4, tr. 1697, show the influence of Montaigne.

Chart. Sea map showing soundings, coast line, lights, and the position of shoals, rocks and banks. They are officially prepared by the Government and sold under cost.

Chartaceous. Organs of a papery consistence or texture.

Charter. Formal writing by which a sovereign or a legislature grants special rights and privileges. In the U. S. charters are generally granted by the legislature. A State charter of a private corporation is a contract between the State and the corporation; it cannot be repealed or altered, unless the State has reserved the right to do so, without violating the U. S. Const., Art. 1, § 10.

Charterhouse. In London; originally a Carthusian monastery, founded 1371; now a hospital, founded 1611 by Sir Thomas Sutton, with a school, removed to Godalming 1872.

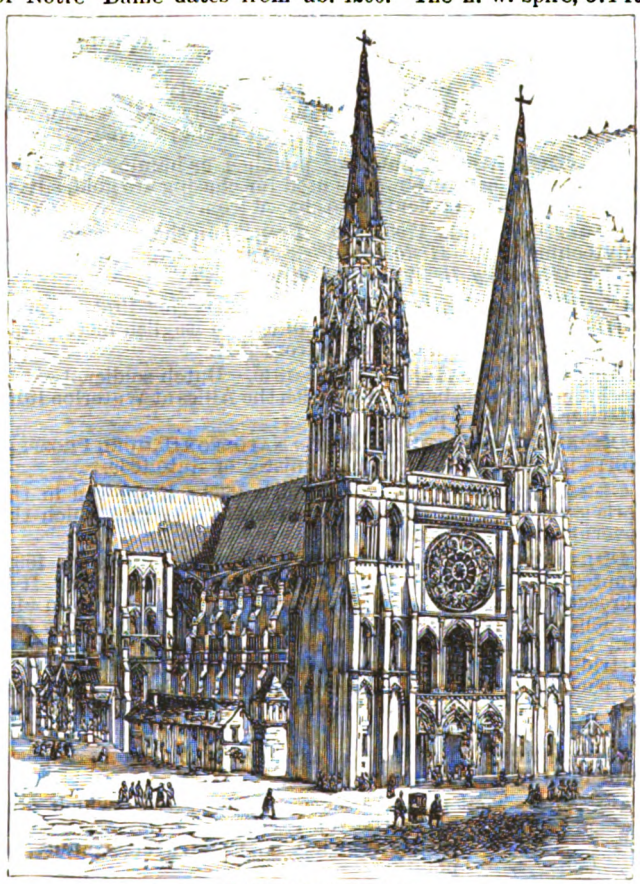
Charter Oak. Tree in Hartford, Conn., in a hollow of which the colonial charter was hidden when its surrender was demanded by James II. in 1687. The tree was blown down 1856.

Charter Party. Contract, generally in writing, by which the owner, or in some cases the master, of a ship leases her, or lets her burden or a part thereof, to a person for the transportation of goods, in consideration of payment of freight.

Chartier, ALAIN, ab. 1392–ab. 1440. French poet. *Livre des quatre Dames.* His prose works also have great merit. *Le Curial* and *L'Espérance* were in the interests of reform; and *Le Quadrilogue Invectif* was aimed against the English.

Chartists. Political reformers in England, who demanded a charter, to guarantee universal suffrage, vote by ballot, annual parliaments, with payment of the members, abolition of the property qualification (enacted 1858), and equal electoral districts. Some outrages were committed 1839 at Birmingham and Newport. The movement spent its force 1838–48.

Chartres. French city, 50 m. s. w. of Paris. Its cathedral of Notre Dame dates from ab. 1200. The n. w. spire, 371 ft.



Cathedral at Chartres.

high, built 1507–14, is considered the most beautiful on the Continent. The cathedral is also famous for 130 windows of 13th-century stained glass. The heir of the Orleans royal branch is styled Duke of Chartres. Pop., 1891, 23,108.

Chartreuse, LA GRANDE. Monastery in s. e. France, founded 1084, several times burned or despoiled. The green and yellow Chartreuse liqueurs are made here. They are sweetened, alcoholic decoctions of various roots and herbs, containing ab. 40 per cent alcohol.

Chartulary. Collection of charters, numerous in France, and dating from ab. 950.

Charybdeidæ (CONOMEDUSÆ, MARSUPIALIDA). Cuboidal acalephs, with a lobe from each corner (interradius) of the oral end, each bearing a long tentacle, and with four wide perradial gastric pouches, into which the genital plates project from the narrow interradial septa. They have a velum with a smooth (not lobed) margin, but as it contains a prolongation of the gastrovascular system it is a velarium, and not a true velum. See CUBOMEDUSÆ.

Charybdis. Whirlpool in the Strait of Messina. See SCYLLA.

Chase. That part of the gun lying in front of the reinforce. The chase ring is the band in front of it.

Chase, PHILANDER, 1775–1852. P. E. Bp. of Ohio 1819, of Illinois 1835; founder of Kenyon College.

Chase, PLINY EARLE, 1820–1886. Prof. at Haverford, Pa., 1871. *Meteorology*, 1884.—His brother THOMAS, LL.D., prof. at Haverford Coll. 1856 and its pres. 1875, pub. Latin text-books, and *Hellas*, 1861.

Chase, SALMON PORTLAND, 1808–1873. U. S. Senator 1849; Gov. of Ohio 1855–59; Sec. Treasury 1861–64; Chief Justice U. S. Supreme Court, 1864. *Statutes of Ohio*, 1833-35. He was a great lawyer, an active opponent of slavery, prominent in the Liberty Conventions 1841–48, and a candidate for the Presidential nomination 1860; but his chief fame rests on his management of the national finances during the war, a herculean task, which he performed with eminent ability and success.

Chase, SAMUEL, 1741–1811. Signer of the Declaration of Independence; Associate-Justice U. S. Supreme Court 1796; impeached and acquitted 1804–5.

Chase, WILLIAM HENRY, 1798–1870. Military engineer, builder of forts in Florida.

Chase, WILLIAM MERRITT, b. 1849. N. A. 1890, pres. S. A. A. Still-life, landscape and portrait painter; main founder and representative of the new school of broad technique in American art.

Chasidim. I. Pietistic and ascetic Jewish sect ab. 170 B. C., who opposed Hellenizing and "worldly" influences. II. Sect in Poland, led by Rabbi Israel of Podolia, d. 1760.

Chasing. Art of finishing punched or hammered metal-work by carving. The metals used for chasing are gold, silver, and bronze. The ancients also chased iron.

Chasles, MICHEL, 1793–1880. French mathematician, prof. Polytechnic 1841. *Historical View of Geometric Methods*, 1834; *Higher Geometry*, 1852; *Conic Sections*, 1865.

Chasles, VICTOR EUPHEMION PHILARETE, 1798–1873. French critic and journalist, who wrote much on English history and literature; prof. Coll. of France from 1841.

Chassé, DAVID HENDRIK, 1765–1849. Dutch soldier, long in the French service, baron 1809; with the Allies at Waterloo 1815; defender of Antwerp 1832.

Chasseloup-Laubat, JUSTIN NAPOLEON SAMUEL PROSPER, COMTE DE, 1805–1873. French minister of state 1869.

Chassepot, ANTOINE ALPHONSE, b. 1833. Employed in the Paris arsenal of St. Thomas, he invented the rifle which the government adopted 1865.

Chassepot. French infantry fire-arm, invented 1863, adopted 1867, and used in the Franco-German war 1870. It is a breech-loading rifle having four grooves, with a twist in 21.6 in., length with saber-bayonet 6 ft., weight with bayonet 10.3 lbs., and without 8.9 lbs; it fired a center-primed paper case cartridge, the obturation being imperfectly effected by a rubber packing at the end of the breech-bolt; initial velocity 1,380 f.s., range one mile, and rapidity of fire ab. 15 shots per minute.

Chasseurs. French light cavalry, employed in Algeria from 1831; also light infantry.

Chassis. That part of a sea-coast gun carriage which supports the top carriage and is traversed to the right or left on the traverse circles, in pointing.

Chasuble.

Chastelard, PIERRE DE BOSCOSEL DE, 1540–1563. French poet, whose love for Mary Stuart brought him to a Scotch gallows; subject of Swinburne's tragedy.

Chastellain, GEORGES, ab. 1405–1475. Flemish poet and chronicler.

Chastellux, FRANÇOIS JEAN, MARQUIS DE, 1734–1788. French author and general; Academician 1775. He fought for American independence 1780–82, and wrote *Travels*, 1786; tr. 1787.

Chastity. Abstention from unlawful lust, and resistance to all impure suggestions.

Chasuble. Robe worn by priests of the Greek and Latin Churches in celebrating mass; sleeveless mantle, originally of elliptical shape, with a hole for the head. In modern Latin use it hangs in front and behind like a long apron with rounded corners, without covering the sides.

Chateaubriand, FRANÇOIS AUGUSTE, VICOMTE DE, 1768–1848. French author; Academician 1811: envoy to Berlin 1820, London 1822, and Rome 1828. *Atala*, 1801; *Genius of Christianity*, 1802; *The Martyrs*, 1810; *Bonaparte and the Bourbons*, 1814; *Memoirs*, 12 vols., 1849–50. He was eloquent but inconsistent.

Châteauroux, MARIE ANNE, DUCHESSE DE, d. 1744. Youngest of four sisters who were successively mistresses of Louis XV.

Châtellerault. Town of France, 40 m. south of Tours, containing a government arms factory, and by the river Vienne, on which it is situated, a port for the district.

Chatham. Borough of England, on s. bank of the Medway, 15 m. above its mouth. It is a military and naval station and is elaborately fortified. It has dockyards 2 m. long and employs 5,000 men. Pop., 1891, 51,711.

Chatham Islands. 360 m. e. of New Zealand, to which they belong, 375 sq. m., discovered by brig Chatham 1791; stock raising and seal fishing employ the inhabitants, 394 in 1886.

Chatham, WILLIAM PITT, EARL OF, 1708–1778. English statesman, M.P. 1735. He led the Whig opposition to Walpole; became Sec. of State 1756; coöperated with Frederick the Great against the French; captured Canada, drove the French from the seas; was ennobled 1766 and premier 1766–68. He opposed the treatment of the American colonies, and was denouncing the government when struck with mortal illness in the House of Lords.

Chatillon. Town of France, on the Seine. The Allied Powers held a congress here Feb. and March 1814. Pop., 1891, 5,127.

Chat Moss. The largest bog in England, in Lancashire, 10 sq. m. in extent, 20–30 ft. deep; the first great bog to be reclaimed, 1800, by drainage.

Chatrian, ALEXANDRE, 1826–1890. French novelist, writing jointly with ERCKMANN (q.v.).

Chats. Some birds of families *Tyrannidæ*, *Turdidæ*, and *Muscicapidæ*.

Chatsworth. In Derbyshire; seat of the Duke of Devonshire, built 1687–1706. The façade is 720 feet long. It has a noted library and a rare collection of pictures and sculptures. The conservatory is the finest in Europe, with 70,000 sq. ft. of glass, and its gardens only surpassed by Versailles. The park is 3 m. broad.

Chattahoochee. Upper water of the APPALACHICOLA RIVER (q.v.).

Chattanooga. City of Hamilton co., Tenn., on left bank of Tennessee R., at s. border of the State. It has good communications and extensive manufactures. Pop., 1890, 29,100, since much increased. Here the Union forces under Gen. Rosecrans were blockaded after the battle of Chickamauga (Sept. 19–20, 1863) by Gen. Bragg, who occupied positions on Missionary Ridge and Lookout Mountain. General Grant assumed command, and by Oct. 28 had secured abundant supplies. Nov. 24th Hooker fought his way up LOOKOUT MOUNTAIN (q.v.). The decisive battle, including Thomas's charge up Missionary Ridge and the rout and retreat of the Confederates, occurred Nov. 25.

Chattel. Any property not real estate. Movables, such as animals, grain, implements, etc., are chattels personal; determinate estates in land, *e.g.*, a lease for 1,000 years, are chattels real. Movables so attached with freehold as to descend to the heir are not chattels. This classification is arbitrary, having its origin in the feudal system.

Chattel Mortgage. Instrument conveying a chattel upon condition that it shall be void if the mortgagor neglects a prescribed act, generally the payment of money. If the condition is not performed, the title at law becomes absolute in the mortgagee; but equity permits him to redeem. The abuse of chattel mortgages has induced legislation in many States, requiring them to be filed in a public office, unless the chattel is delivered to and retained by the mortgagee.

Chatterton, THOMAS, 1752–1770. Author of the pseudo-antique "Rowley" poems; called by Wordsworth "the marvelous boy, the sleepless soul that perished in his pride." His case is one of the saddest in the history of letters. He committed suicide with arsenic.

Chaturanga. Ancient Hindu game of chess, in which the moves were made according to the throws with a die marked on four sides with the numbers 2, 3, 4 and 5. There were four players, each having his own set of men, which were ranged in the four quarters of the board of 64 squares. The pieces, which were distinguished on the four sides by the colors

red, green, yellow and black, consisted of four pawns, placed in the outer rows, and a Shah or King, Elephant, Horse and Ship. This game is described in detail in the *Bhavishya Purana*, a portion of the great epic poem the Mahabharata, and existed till the 10th century.

Chaucer, GEOFFREY, ab. 1340–1400. "Father of English poetry." His productive career may be divided into four periods: (1) to 1371, including his early poems; (2) 1372–81, *Troilus and Cresside, Anelida, Former Age;* (3) 1382–89, *The*

Geoffrey Chaucer.

Parliament of Foules, House of Fame, Legende of Goode Women, principal *Canterbury Tales;* (4) 1390–1400, latest CANTERBURY TALES (q.v.), *Ballades,* etc. Certain poems once attributed to him, *The Flower and the Leaf, Chaucer's Dreme,* and *Romaunt of the Rose,* are now rejected as his by critics.

Chaulmoogra Oil. Oil expressed from seeds of *Gynocardia odorata;* used in the treatment of leprosy, rheumatism, and various diseases of the skin.

Chaumont (FRANCE), TREATY OF. March 1, 1814, between the powers allied against France.

Chauncey, ISAAC, U.S.N., 1772–1840. He commanded the *Chesapeake* 1802 in the war against Tripoli, and in that of 1812 had command of the Lakes.—His son, JOHN S., ab. 1800–1871, became a commodore 1862.

Chauvenet, WILLIAM, 1820–1870. Mathematician; prof. U. S. Naval Academy 1845–59; Chancellor Washington University, St. Louis, Mo., 1862–69. *Plane and Spherical Trigonometry,* 1850; *Astronomy,* 1863; *Geometry,* 1869.

Chauvinism. Narrow, exaggerated, and pugnacious patriotism. French term, equivalent to the later English "jingoism."

Chaw Stick. *Gouania domingensis.* Climbing shrub of the natural family *Rhamnaceæ,* native of tropical America. Its stems are used for tooth-brushes.

Chayroot. *Oldenlandia umbellata.* East Indian herb of the natural family *Rubiaceæ,* cultivated for its roots, which yield a blue dye, changed by mordants to a variety of reds.

Chazars. Finnish or Tartar race, dominant in s. e. Russia ab. 700–1000. Astrakhan was their capital.

Chazy. Palæozoic limestone, cropping out in New York and Canada, and lying near the bottom of the Trenton. See ORDOVICIAN.

Cheat. Crime of obtaining property by a deceitful and illegal practice which tends to affect the public, as by a false official certificate, a false token, false weights and measures, false personation, or by selling food known to be unwholesome. Modern legislation tends to enlarge the boundaries of this offense.

Cheat Grass. *Bromus secalinus.* Grass, common in wheat fields, erroneously supposed to be altered wheat; known also as Chess, in common with other grasses of the same genus.

Checa, ULPIANO, b. 1860. Spanish artist, who won the *Prix de Rome* 1884. *Invasion of the Barbarians,* 1887; *Roman Chariot Race,* 1890; *Attila,* 1891; *Redskins,* 1892; *Naumachia,* 1894; *Unlucky Meeting,* 1894.

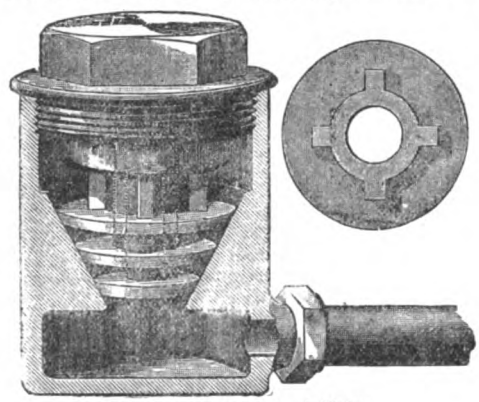
Check, or CHEQUE. Written order for money, drawn on a bank or banker, payable to a person named, or to his order, or to bearer. In legal effect it is a bill of exchange. A certified check is one recognized by cashier or other competent officer by writing across the face that it is all right, or will be paid. If the holder gets it thus certified, he thereby discharges the drawer. If not presented for payment within a reasonable time, an indorser is discharged, but the drawer is not, except to the amount he has been injured by the delay, as by the failure of the bank.

Checkerberry. See WINTERGREEN.

Checkers. See DRAUGHTS.

Checks TO POPULATION. Causes that reduce natural increase of population, especially scarcity of the necessaries of life, disease, war, infanticide, and voluntary restraint from marriage or sexual intercourse.

Check-Valve. Valve to prevent any flow back of fluid. It



Locomotive Boiler Check-Valve.

lifts from its seat by excess of pressure below it, but closes when any reversal of current occurs. Smaller sizes are of brass or with special renewable alloys at the contact areas; they either lift straight, or open around a hinge-pin. They are fitted with a cap over the valve by which it can be reached for inspection or repair, and may be used either in horizontal or vertical lines of pipe.

Checquy. Division of the heraldic shield into an unlimited number of small squares by transverse horizontal and perpendicular even lines; found in all countries and in all periods.

Cheeks. Inclosing walls of a mineral vein, when vertical or nearly so.

Cheeks. Parts of the artillery carriage which support the trunnions, and between which the gun is mounted.

Cheese. When rennet is added to milk at a temperature of 86° F., or a little less, the casein assumes a solid form, and in so doing incloses a large part of the fat globules of the milk. The resulting mass is then heated, to further solidify the casein, separated from the whey, and pressed into solid form. In a few days certain fermentation processes begin and continue for several weeks, after which the casein is found to have become again more or less soluble. This is cheese, one of the most concentrated and nutritious forms of human food known. It consists of nearly equal parts of casein fat and water. Many varieties are known, varying greatly in flavor and texture, from variations in the quality of the milk and the foods producing it, and more especially in processes of manufacture, particularly of curing.

Cheddar cheese, the most common form, takes its name from a village in Somerset, and is largely made both in Great Britain and the U. S. Stilton is an English cheese, made from milk to which cream has been added. Camembert and Brie are soft French cheeses. Roquefort, also French, is largely made from goat's milk, and is cured in caves, where a peculiar fermentation is induced by certain vegetable moulds. The peculiar character of the Swiss or Gruyère cheese is supposed to be due to Alpine grasses upon which the cows feed.

Edam and Gouda cheeses are made in Holland, and are hard and intended for long keeping. In Limburger a putrefactive fermentation is induced and then checked when the desired flavors have been produced. In many European countries cheese largely takes the place of meat as an article of food, particularly among the poorer classes. See DAIRY PRODUCTS.

Cheeses. See MALLOW.

Cheetah. See FELIDÆ.

Cheever, EZEKIEL, 1615–1708. One of three founders of New Haven, Conn., 1638; head of Boston Latin School 1671. His Latin *Accidence* was long in use.

Cheever, GEORGE BARRELL, D.D., 1807–1890. Reformer, journalist and author; pastor in N. Y. 1839–70.—His brother, HENRY THEODORE, b. 1814, wrote or edited many books.

Cheiloplasty. Plastic operation for the restoration of lips, destroyed by operations for cancer or other means.

Cheiromydæ. Family of Lemurs (*Prosimiæ*), including only the Aye-Aye of Madagascar, which has a squirrel-like ap-

Aye-Aye (*Cheiromys madagascariensis*).

pearance, with but one pair of incisors in each jaw of rodent-like shape and rootless, and no canines. Hands, with opposable thumbs, are present only on the hind limbs.

Cheiroptera (BATS). Order of deciduate-placental mammals possessing true powers of flight, to effect which a patagium, including the tail and limbs and the fingers of the hand (except the thumb), is always present. The chest is strong with a sternal keel, and the scapula is large for the attachment of the muscles principally concerned in flight. The bones of the arm are long, especially the radius, the ulna is rudimentary. The metacarpals and phalanges included in the web are extremely long, the index digit sometimes consists of the metacarpal only. The medius is the longest digit. None of these possess claws as do the thumb and toes. The fibula is incomplete. A long spur or calcar extends backward from the oscalcis for supporting the web near the tail. The organs of vision are not well developed, and bats fly usually at night. The ears are large, but touch is the sense most developed, blinded bats fly as well as others, avoiding obstacles. During the day they retire to caves and crevices, where they hang suspended by the hind feet. In temperate and cold regions they hibernate. They walk with difficulty, and are not as active in flight as most birds. They have one or two young at a time, which are carried with them during flight and are suckled by a pair of pectoral mammæ. They first appear in the Eocene, but offer no special peculiarities. The dentition is complete. There are two groups. See BAT.

Cheiropterygium, or CHIROPTERYGIUM. Form of vertebrate limb which has fingers and toes conceived as formed from an axis of mesomeres constituting the humerus, intermedium, centrale, third carpal, and third digit, and having two parameres on each side, according to Huxley. See ARCHIPTERYGIUM. Wiedersheim makes the second digit the axis in which the ulna enters also, and the thumb represents the single paramere on one side, and three parameres being on the other.

Cheirotherium. Hand-like tracks of an amphibian, probably Labyrinthodont.

Cheke, SIR JOHN, 1514–1557. First prof. of Greek at Cambridge, 1550; tutor of Edward VI.

Chelæ. Pincers of Crabs, produced by the terminal joint closing against a projection of the preceding joint.

Cheliceræ. Pincers on the mandibular palps of scorpions.

Cheliferidæ. See PSEUDOSCORPIONIDÆ.

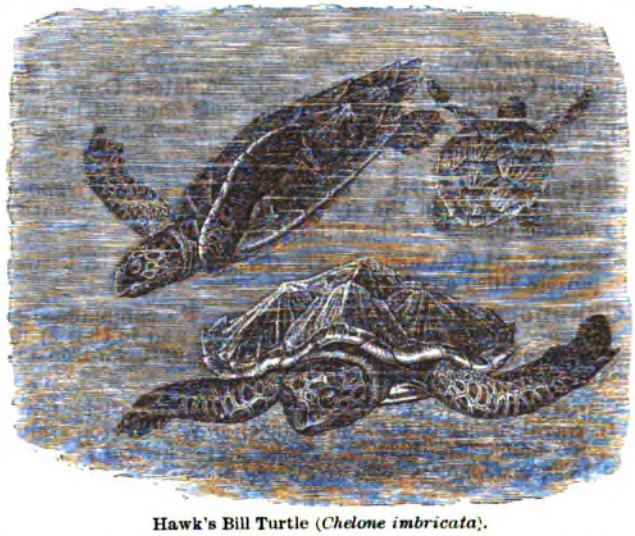
Chelmsford, FREDERICK THESIGER, BARON, 1794–1878. Solicitor-General and knight 1844; Atty.-Gen. 1845–6, and 1852; Lord Chancellor 1858–59 and 1866–68.—His son, FREDERICK AUGUSTUS, b. 1827, served in the Crimea, India, and Africa, was Gov. of Cape Colony, succeeded to the barony, and became Lt.-Gen. 1882.

Chelmsfordite. Variety of Wernerite found at Chelmsford, Mass.

Cheloid. Warty elevation which sometimes develops in scars, especially those left after burns; treated by excision, but apt to return, however.

Chelonia (TURTLES). Sub-class of *Reptilia*, having short and stout body inclosed in a case consisting of a dorsal arched carapace and a flat ventral plastron united at the sides, but leaving anterior and posterior apertures for the protrusion of head, tail and limbs. The dorsal vertebræ have expanded spinous processes, are firmly anchylosed to one another, and bear broad ribs, also united, and the whole fused with the dermal plates of the case, which is again covered by horny or leathery epidermis. There are eight neck vertebræ without ribs, and a skull of bones closely united, without teeth in the jaws, but with a horny beak instead. A urinary bladder is present; breathing is effected by swallowing air into the lungs. According to Agassiz, in N. A. Marsh Tortoises copulation is effected twice annually, and begins in the seventh year. Eggs are laid once annually, beginning in the eleventh year. The principal families are: *Cheloniadæ* (Sea Turtles), *Trionycidæ* (Mud Tortoises), *Emydidæ* (Terrapins), and *Testudinidæ* or *Chersidæ* (Land Tortoises), *Chelydidæ*, *Cinosternidæ*, *Chelydridæ*, and *Spargidæ*.

Cheloniadæ (SEA TURTLES). Family of *Chelonia*, having flat carapace and often cartilaginous plastron between which the flipper-like feet and huge head cannot be retracted. There are no nails or separate toes, and the fore feet are much the larger. The Green Turtle (*Chelone midas*) is much esteemed as food, with its eggs. It lives in or near the Gulf Stream, feeds on the roots of eelgrass (*Zostera*), comes ashore at night, during May, and lays nearly 100 eggs, which hatch in six weeks; the laying is usually repeated several times every two weeks, near the first nest. This Turtle may attain a weight of over 800



Hawk's Bill Turtle (*Chelone imbricata*).

lbs. The Logger-head Turtle, so-called from its huge head and neck, ranges from Brazil to Mass., attains a weight half that of the Green Turtle, and feeds on fish, crustacea, conchs, etc. The Hawk's Bill (*Eretmochelys*) has pointed imbricated plates that supply the "Tortoise Shell" of commerce.

Chelonobatracha. See ANOURA.

Chelophora. See PROBOSCIDIA (Elephants).

Chelsea. Suburb of London, on n. bank of the Thames. Pop., 1891, 96,272.

Chelsea. City of Suffolk co., Mass., on n. side of Boston harbor, 3 m. n. e. of Boston. Its manufactures are principally of iron, steel, and cotton goods. It was first settled 1630, and chartered as a city 1857. Pop., 1890, 27,909.

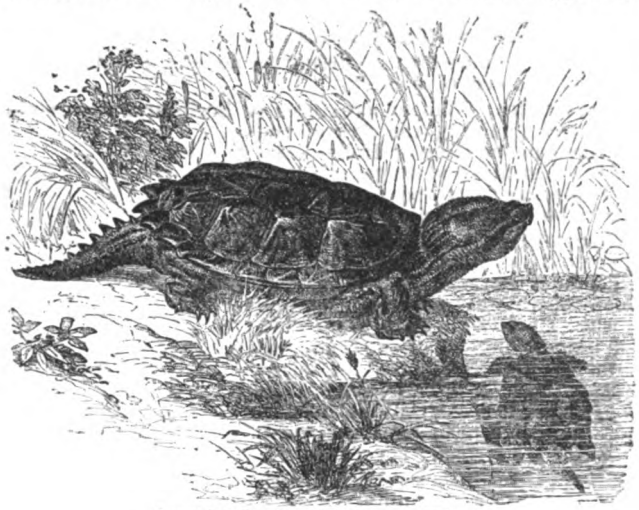
Chelsea Hospital. Asylum for old and disabled British soldiers, opened near London 1692; supported by Parliamentary grants.

Cheltenham. Borough of Gloucestershire, containing mineral springs of repute, which render it a fashionable resort. Pop., 1891, 42,914.

Chelydidæ. Family of *Chelonia*; includes Tortoises characterized by very long necks, which are folded under the edge of the shell; not retracted as in many others. A S. American variety has a head and neck bearing peculiar weed-like growths; as it feeds on ducks, etc., these are protective.

Chelydridæ (SNAPPING TURTLES). Family of *Chelonia*, characterized by incomplete cruciform plastron, ribs separate at the outer ends, and the epidermis is leathery. The sharp beak has fleshy lips; the tail is long and somewhat resembles that of the Alligator. The head and feet are not retractile be-

neath the carapace. *Chelydra serpentina* is type of the family. It may attain a length of 3 ft. It lays 24 or more eggs in the



Snapping Turtle (*Chelydra serpentina*).

sand in the early morning, excavating the nest with its hind feet.

Chemical Affinity. Force which holds together the smallest particles or atoms of chemical compounds.

Chemin-de-Ronde. Beam from 4 to 12 ft. broad, between foot of exterior slope of parapet and scarp wall.

Chemistry. The history of Chemistry, including Alchemy and Iatrochemistry, extends back to the beginning of our era. The doctrine of the Alchemists and the Iatrochemists were accepted for centuries, and not until ab. 1650, was Chemistry in a position to stand forth as a true science—science meaning classified knowledge; even then many chemists still clung to the alchemistic and iatro ideas. There was a slow period of transition, in which men gradually gave up the old ideas and accepted the doctrine that Chemistry was to teach concerning the composition of substances, and had nothing in common with the search for the Philosopher's Stone or Elixir Vitæ. The first book on Chemistry, by Libavius 1595, defined it as the art of making healing remedies. Diseases were to be conquered by medicines which the Chemists were to discover and prepare. Among the most enthusiastic of the Iatrochemists was Paracelsus, 1493–1541. He was successful in making a large number of remarkable cures by the use of chemicals. This gave him great prominence and led to his ideas being widely accepted. He was the first to use corrosive sublimate, copper sulphate, sugar of lead and certain compounds of antimony as medicines; he seems also to have made a judicious use of laudanum. Another prominent Iatrochemist was Van Helmont, 1577–1644. He enriched Chemistry by many valuable observations, especially in regard to gases. He taught that the same element was always present in its compounds and could be recovered by proper means. He examined carbon-dioxide with great care, showing how it could be made, giving its properties, etc. The period of Iatrochemistry closed with Lemery, 1645–1715. With Robert Boyle, 1626–1691, a new era was introduced. He vigorously opposed the views of the Iatrochemists. He had the genius of invention, and pointed out the path which Chemistry was to follow and did follow. His services were manifold; he defined the term Element with sharpness and precision, gave the word Compound its present meaning, and accounted for the differences in the properties of Elements as being due to differences in size, shape or weight of the smallest particles of the Elements. It was his endeavor to learn the composition of substances which laid the first foundations of Analytical Chemistry. Next to guide the Science was Stahl, 1660–1734. To explain the phenomena of Combustion, he proposed the Phlogiston Theory, which was almost universally accepted and regarded as true for ab. 150 years. In terms of this theory, all substances capable of burning contain something (Phlogiston), which escaped during the process of combustion. To explain the fact that simple substances became heavier when burned, it was assumed that Phlogiston conferred a principle of Levity. This idea of Combustion was the only one which was held until the correct explanation was given by Lavoisier, 1743–1794, who established many facts himself, and gained others by the discoveries of Priestley, Cavendish and Scheele, the most important being the discovery of Oxygen by Priestley. Thus far chemists had investigated the qualities of substances, but in the latter part of the 18th century the quantitative method came into use, and the proportions of substances that combined together to form compounds became an object of study, and Quantitative Chemical Analysis was introduced. Early in the 19th century it was established that Chemical Compounds have a fixed composition, and Proust, who contributed much to prove this, also showed that two bodies may combine in more than one proportion, and that for each combination the relative proportions are fixed. These two facts being established, the next important event was the proposal of the ATOMIC THEORY (q.v.) by John Dalton 1804. It has been called the guiding star of modern Chemistry, and is the basis for the explanation of all chemical phenomena. This theory assumes that matter is composed of indivisible Atoms of definite weights and that a Chemical Compound contains a definite number of Atoms of its constituents. The determination of the weights of the Atoms now became the object of study and the improvement of the balance a matter of importance. Dalton, Wollaston and Berzelius contributed much to this subject. In 1808 Gay Lussac and Humboldt discovered the simple constitution of gaseous compounds, and Avogadro in 1811 announced his hypothesis, that all Gases contain in equal volumes the same number of Molecules. This led to the discovery that there was a fixed relation between the Atomic Weight and the specific gravity of gaseous elementary and compound substances. In 1819 Dulong and Petit established the law that elementary Atoms have the same capacity for heat, and in 1831 Newmann and Regnault a similar law for Molecules of Chemical Compounds. The Atomic Weights, now in use, are based upon these various laws and hypotheses, and constitute the foundation of Chemistry as an exact science. Supplementary to these is the theory of Valence, which adds to the properties of elementary Atoms the power of attraction of one or more Atoms of other elements, depending upon the relative Valence of the various Elements. The most important contribution to the science in recent years were two papers, one published by Mendeleëff 1869, the other by Lothar Meyer 1870, which it is claimed were anticipated by Newlands in 1864. They proposed a classification of the Elements in a manner which brought to light many hitherto unrevealed similarities and differences, and by means of which the existence of other Elements may be prognosticated. It has been called the Periodic Table, and is based on the PERIODIC LAW (q.v.). This classification is the most perfect one we have, and is justly regarded as the greatest recent achievement of the science. In 1828 Wöhler discovered accidentally that Urea could be made artificially, and this was the birth of Organic Chemistry. This was the first organic compound which had been made in the laboratory. Since then the number of chemical compounds, formerly considered to be only obtained from animals and plants, which have been prepared artificially is very large; these must not be confused with organized animal and vegetable matter, such as animal or vegetable cells or tissues, which have never been produced except through animal and vegetable life. Dependent upon the development of the science of Chemistry is the great progress made in the useful arts and industries, all of which have derived great benefits, in new products and processes, in the reduction in cost of production and in the utilization of hitherto waste products. See ORGANIC CHEMISTRY, ALCHEMY, PHYSIOLOGICAL CHEMISTRY.

Chemnitz. City of Saxony, on the Chemnitz, at foot of the Erzgebirge; noted for its manufactures of woolen goods. It was a free city of the Empire 1125. Pop., 1890, 138,955.

Chemnitz, MARTIN, 1522–1586. German theologian, placed next to Luther by Bossuet. He wrote 4 vols. on the Council of Trent, 1565–73, and *Loci Theologici*, 1591.

Chemosh. Moabite god, identical with Baal and Moloch.

Chemung. One of the Devonian strata in New York, so named by Prof. Hall. It consists principally of shales, and lies above the Hamilton and below the Catskill. See DEVONIAN.

Chenery, THOMAS, 1826–1884. English orientalist, O. T. reviser; prof. at Oxford 1868–77; ed. London *Times* from 1877.

Cheney, CHARLES EDWARD, D.D., b. 1836. Rector in Chicago 1860; Bp. Ref. Epis. Ch. 1873.

Cheney, JOHN VANCE, b. 1848. American poet.

Chénier, ANDRE MARIE DE, 1762–1794. French poet of great promise, whose career was cut short by the guillotine.—His brother, MARIE JOSEPH BLAISE DE, 1764–1811, wrote three influential plays: *Charles IX.*, 1789; *Caius Gracchus*, 1792; and *Timoleon*, 1794, and many songs, among them *Chant du départ.* Both were born of a Greek mother at Constantinople.

Chenomorphæ. Order of Birds, equivalent to the *Lamellirostres* in part. Swans, Geese, Ducks, and Goosander are examples.

Chenopodiaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledones*, compris-

ing 83 genera and ab. 520 species, distributed throughout all parts of the earth; the Goosefoot family.

Cheops. King of Memphis, Egypt, of the 4th dynasty, ab. 2500 B.C.; builder of the largest existing pyramid. See PYRAMIDS.

Cherbourg. Fortified naval station of France, on the English Channel, begun by Vauban 1687; taken by the English 1758; improved by Napoleon I. and III.; supplemented by additional works 1883–94; protected by a gigantic breakwater and

Cherbourg.

numerous forts. It has an outer and an inner harbor; the latter, 20 acres in extent, is cut out of solid rock. Pop., 1891, 38,554, or with suburbs ab. 53,000.

Cherbuliez, VICTOR, b. 1829 at Geneva. French novelist, Academician 1882. *Count Kostia*, 1863; *An Honest Woman*, 1866; *Ladislas Bolski*, 1869; *Joseph Noirel*, 1872; *Meta Holdenis*, 1873; *Samuel Brohl and Co.*, 1877; *Jean Teterol's Idea*, 1878; *Count Ghislain*, 1888.—His uncle, ANTOINE ELISEE, 1797–1869, prof. at Geneva and Zurich, was a noted political economist.

Cherimoyer. Fruit of *Anona cherimolia*, a small tree of the Custard Apple family, native of tropical America.

Cheriton Down, HANTS. Scene of Waller's victory over the royalists under Lord Hopton, March 29, 1644.

Cherokees. Tribe of N. American Indians who ranged from N. C. through Tenn. to Ark., including the north of Ga., Ala., Miss. and La. In the French and Revolutionary wars they sided with the English, and fought for the South in the Rebellion. The Cherokee Nation in the I. T. now includes 11,531 pure bloods, and the Eastern Cherokee Agency in N. C. contains 2,885.

Cherokee War. In N. C. and Tenn., 1760. The Cherokees captured Fort Loudon and massacred the garrison, but were soon subdued.

Cherry. Trees of the genus *Prunus*, natural family *Rosaceæ*, natives of both hemispheres; introduced into Italy from Cerasus in Pontus by Lucullus ab. 66 B.C. The cultivated sorts are mainly derivatives from *P. cerasus* and *P. avium*, indigenous in Europe and w. Asia. The Bird Cherry of Europe is *P. padus;* there are several related species in N. America.

Cherry, AUSTRALIAN. *Exocarpus cupressiformis.* Small tree of the natural family *Santalaceæ*, native of Australasia, producing a very hard wood, used for ax-handles, etc.

Cherry, BARBADOES. *Malpighia glabra* and *M. punicifolia.* Small trees of the natural family *Malpighiaceæ*, natives of tropical America, used for hedges.

Cherry Coal. Free-burning, non-caking, lustrous bituminous coal, found in England.

Cherry, CORNELIAN. *Cornus mas.* Small tree of the Dogwood family, native of n. Europe and Asia. Its fruit is translucent, red and oblong.

Cherry Laurel. *Prunus laurocerasus.* Evergreen shrub of the natural family *Rosaceæ*, native of Armenia, and extensively cultivated.

Cherry Slug. *Selandra cerasi.* Larva of small jet-black sawfly, is two-thirds in. long, green and slimy, defoliates fruit trees; two broods per season; arsenites and air-slaked lime kill them.

Cherry Valley Massacre. In Otsego co., N. Y., Oct. 11, 1778, by Indians and Tories. 16 soldiers and 32 villagers were killed, and the rest carried into captivity.

Chersidæ. See TESTUDINIDÆ.

Chert. Impure flint occurring as nodules in limestone, as the true flint occurs in chalk.

Cherubim. Winged creatures of Scripture, represented by figures guarding the Ark of the Covenant in the Holy of Holies.—Allied to the griffins and winged sphinxes of Phœnician art, and the human-headed bulls of Assyria.

Cherub.

Cherubini, MARIA LUIGI CARLO ZENOBIO SALVATORE, 1760–1842. Italian composer in nearly all forms, but chiefly successful in opera and church music. He lived in Paris from 1784, and became director of the Conservatoire. Beethoven admired his operas greatly. *Lodoïska*, 1791; *Medée*, 1797; *Les Deux Journées*, 1800 (his masterwork); *Faniska*, 1806; *Les Abencèrages*, 1813.

Chervil. *Anthriscus cerifolium.* Herb of the Carrot family, native of Europe, introduced into N. America.

Chesapeake. American frigate of 38 tons, commanded by Capt. James Lawrence; boarded by the British frigate Shannon June 1, 1813, six leagues east of Boston harbor. All its officers were killed or disabled.

Chesapeake Bay. Deep indentation in e. coast of U. S., in Md. and Va. Into it flow the Susquehanna, Potomac, James, and other rivers. At its mouth the British Admiral Graves was worsted by De Grasse, Sept. 5, 1781.

Chesbrough, ELLIS SYLVESTER, 1813–1886. American civil and sanitary engineer, designer of the sewage systems of Chicago and other cities.

Cheselden, WILLIAM, F.R.S., 1688–1752. English surgeon. *Anatomy*, 1713–33.

Cheshire. See SWINE.

Chesney, CHARLES CORNWALLIS, 1826–1876. British officer, prof. at Sandhurst 1858. *Campaigns in Va. and Md.*, 1863–65; *Waterloo Lectures*, 1868; *Military Biography*, 1874.—His brother, Gen. SIR GEORGE TOMKYNS, 1830–1895, pub. *The Battle of Dorking*, 1871, and *The Private Secretary*, 1881.—Their uncle, Gen. FRANCIS RAWDON, 1789–1872, was a military explorer in Asia. *Survey of the Euphrates and Tigris*, 4 vols., 1850.

Chess. *Bromus secalinus.* Weed of the Grass family, very troublesome in wheat fields. It is an annual; clean culture and the sowing of absolutely clean seed are the only means of keeping it in check. It is believed by ignorant people that the wheat plant under unfavorable conditions will produce or turn into chess; but repeated standing offers of large rewards have failed to produce a single authentic specimen of chess produced from the seed of wheat. Chess has a slight value as a forage plant, if cut and cured before it has ripened its seed. See CHEAT-GRASS.

Chess. White pine or spruce planks, each 18 ft. long, 4½ in. wide and 1½ in. thick, used as floor-covering for a pontoon bridge.

Chess. Most renowned game of skill known to the civilized world, usually played upon a square board marked with 64 squares, by two persons, each with 16 men, consisting of 8 pawns, 2 castles or rooks, 2 bishops, 2 knights, and a queen and king, the latter being the object of attack. Its invention has been attributed to the Persians, and its names in European and Asiatic languages are derived from that of the principal piece, the shah or king. From internal evidence, the game could not have been a direct invention, but appears to be a modification of an ancient method of divination. It retained its divinatory charactor in Europe till the 10th century. Its immediate ancestor was a game of dice chess, played by four persons, of which the Hindoo Chaturanga is a significant type, and probably in the direct ancestral line. This may be regarded in turn as having been preceded by a dice game played by four persons, each with 4 men, not differentiated, except by color, around the arms of a cross, as in the existing Hindoo game of pachesi or chausas. Another step backward, and the cross is found to have been derived from a circle with an internal cross. At this stage 4 slaves were used instead of dice to regulate the throws, as in the Korean game of nyout. A rudimentary game, the product of the same course of change or evolution, occurs among the Indians of the s. w. U. S. The chess-board may be regarded as symbolizing the world and its

quarters, and the men or pieces, the people of the several directions. Chess occurs in China under the name of ts'eung kí, in Korea as tz yang kí, and in Japan as shozi. These games differ from that of India and Europe, and from each other, and preserve certain features of the games which preceded chess, from which it appears that they were not derived directly from the existing game of India. The modern game was developed ab. 1500 by increasing the powers of the queen, bishop, and pawns, and by castling the king. In 1474 Caxton printed an English version of a work on chess written by Cesolis, a Dominican friar, ab. 1200. Masters of the game became famous in the next century, Spain, Portugal, and Italy producing experts whose gambits or openings are still in common use. Treatises were written among others by Damiano 1512, Ruy Lopez 1512, Gianutio 1597, Salvio 1604, Carrera 1617, and Augustus, Duke of Brunswick-Luneburg, 1617. Other famous players of the 17th and 18th centuries were Grecó, Bertin, Cunningham and Philidor, who in 1795 reintroduced blindfold play which had been exhibited by Buceca, a Saracen, ab. 1550. More modern authorities of the game were Sarralt, Cochrane, Lewis, Walker, Jaenish and Staunton. Chess tournaments as the best means of settling international championships were instituted 1851. In 1858 Paul Morphy of New Orleans defeated the best European players, and at Hastings, Eng., 1895, H. N. Pillsbury of Brooklyn proved himself superior to the experts of the Old World. Morphy could play twelve simultaneous games blindfold, a feat now surpassed by Blackburne and others.

From Caxton's Game of Chess, 1474.

Chessy Copper. See AZURITE.

Chest. Portion of the body bounded by the ribs and the vertebræ with which they are connected, the breast-bone, diaphragm, and lower part of the neck, and containing the heart and lungs and the large blood vessels connected with them.

Chest, AMMUNITION. Box placed on the limber of a field gun to contain ammunition for the service of the piece. It is made of wood for lightness, and is divided into three compartments: the projectiles are placed upright in the end divisions, and the cartridges in the middle division; the lid opens up. Each chest carries 42 rounds, and is interchangeable with those on the caisson. In rapid movements the cannoneers are mounted on it.

Chest, MILITARY. Money and negotiable securities carried by an army to pay its current expenses. The expenditures are made by officers of the quartermaster, subsistence and pay departments.

Chester. Uppermost division of the Carboniferous limestone as it occurs in the Mississippi Valley. See CARBONIFEROUS.

Chester. Ancient city of England, capital of Cheshire, on the Dee, 22 m. from the sea; irregularly laid out and surrounded by walls; rebuilt 908. It resisted William I. till 1070, and was besieged by a parliamentary army from July 1643 till Feb. 3, 1646. Pop., 1891, 37,105.

Chester. A city of Delaware co., Pa., on right bank of the Delaware, 18 m. below Philadelphia; noted for its extensive shipbuilding interests. Pop., 1890, 20,226.

Chesterfield, PHILIP DORMER STANHOPE, EARL OF, 1694–1773. English statesman noted for his polished manners. *Letters to his Son*, 1774.

Chester White. See SWINE.

Chestnut. Forest tree of the natural family *Fagaceæ*, native of the n. hemisphere. The European species is *Castanea sativa*, and the American, *Castanea dentata*.

Chestnut, CAPE. S. African tree, *Calodendron capense*, bearing a prickly fruit; species of the natural family *Rutaceæ*.

Chestnut, EARTH. In England, nut-like tubers of *Bunium bulbocastanum*, herbs of the Carrot family, natives of Europe.

Chestnut, HORSE. See HORSE CHESTNUT.

Chestnut Street Bridge. Cast-iron highway bridge over the Schuylkill River at Philadelphia, formed by two arches of 185 ft. span and 20 ft. rise. Each arch has six ribs ab. 8 ft. apart and 4 ft. in depth. The structure is remarkable for its beauty, and was completed in 1866.

Chestnut, TAHITI. *Inocarpus edulis*. Large tree of the natural family *Leguminosæ*, common in the S. Sea Islands; esteemed for its seeds, which are used as food.

Chestnut Timber. When dry, its weight is 41 lbs. per cubic foot, its tensile strength ab. 12,000 and its compressive strength ab. 6,000 lbs. per sq. inch.

Chestnut, WATER. *Trapa natans*. Aquatic plant of the natural family *Hydrocaryaceæ*, native of s. Europe. The seeds contain much starchy matter, and are an important food product. The fruits bear horn-like projections, and are also known as Water Caltrops, and in Italy as Jesuit Chestnuts.

Chetifera. See CHÆTIFERA.

Chettle, HENRY, d. ab. 1607. English dramatist.

Chevalier. Title of younger sons of some French houses, of the Stuart Pretenders to the English throne, and often of other adventurers.

Chevalier, MICHEL, 1806–1879. French economist; Prof. Col. of France 1840, senator 1861. *Cours d'Économie Politique; La Baisse d'Or.*

Chevaux-de-Frise. Obstacle, used chiefly against cavalry; horizontal piece of timber, 10 ft. long by 6 in. or more in diameter, with pointed poles driven through at right angles to each other and 5 in. apart. The separate parts are strongly bolted together to form a continuous obstacle.

Cheverus, JEAN LOUIS ANNE MADELEINE LEFEBVRE, D.D., 1768–1836. French priest; missionary in New England 1796, Bp. of Boston 1808, Abp. of Bordeaux 1826, Cardinal 1835.

Cheviot Hills. Between Scotland and England; greatest ht. 2,684 ft.

Chevreul, MICHEL EUGENE, 1786–1889. French chemist; director of the dye works of Gobelin 1824; prof. in Paris 1829. His most important work was on the fats.

Michel Eugene Chevreul.

Chevron. Arrow-headed stripes or other designated devices, worn on the coat sleeves, indicating rank of non-commissioned officers in U. S. army, and of cadet officers at West Point. They vary in color and material, to indicate the arm of the service. A diagonal half chevron of gold lace for each enlistment and one for war service is also authorized for enlisted men.

Chevron Bones. Wedge or arch-shaped bones on the ventral side of the tail in lizards, turtles, and crocodiles.

Chevrotain. See TRAGULINA.

Chevy Chase. Ballad founded in part on the battle of OTTERBURN (q. v.).

Cheyenne. Capital of Laramie co., and of Wyoming, near e. base of Rocky Mts., founded 1867. Pop., 1890, 11,690.

Cheyenne River. Right hand branch of the Missouri, draining the Black Hills of Dakota. Drainage area 24,117 sq. m.

Cheyennes. Indian tribe of the Algonquin family, originally living on the C. branch of the Red R. Dak. Tall, strong, and brave, their history is one of constant war with their neighbors and the whites. There are now in Montana 865 Oklahoma 1,091, and S. Dakota 517.

Cheyne, THOMAS KELLY, D.D., b. 1841. Prof. Oxford 1885; commentator on Isaiah and the Psalms.

Cheyney, EDWARD P., b. 1861. Prof. History Univ. Penna.

Chézy, ANTOINE LEONARD DE, 1773–1832. French Orientalist, prof. Paris 1814.

Chiabrera, GABRIELLO, 1552–1637. Italian poet, imitator of the Greeks.

Chianti. Dealers call all Tuscan wines by this name, because the best vintage is that of the hills of Chianti 15 m. n. of Siena. It is an overrated wine, losing much of its native excellence by transportation.

Chiaroscuro. Treatment of lights and shadows, especially in paintings in which the contrasts are especially pronounced and the shadows unusually dark. Da Vinci first developed this method; his greatest Italian follower in this direction was Correggio. Rembrandt was the great master of this art in the 17th century.

Chiasmodontidæ. Family of Acanthopterygian fishes, of which the type is *Chiasmodon niger*, or the Black Swallower, living at a depth in the ocean of nearly a mile. It has a gape extending far back of the eyes; the jaws are beset with teeth like those of the Python, and it frequently swallows a fish whole, containing ten times its own bulk. Its stomach and belly are so distensible that their walls will stretch to accommodate this enormous meal; becoming so transparent that the species of fish swallowed may be discerned. Sometimes gases are generated by the decomposing morsel which float the captor, and thus several museum specimens have been secured.

Chiastolite. Variety of Andalusite, occurring in stout crystals and showing in cross section marks that resemble the Greek letter Chi (χ) in form. Also called Macle.

Chiastoneura. See TÆNIOGLOSSA.

Chicago. City of Cook co., Ill., second largest of the U. S.; on w. shore of Lake Michigan near its head. The site is nearly level, and raised but a few feet above the lake. It is traversed by C. River, a sluggish, crooked stream, but navigable for lake vessels. A breakwater has been constructed in the lake, forming a fairly good harbor. It is the principal port of the Great Lakes, has a large commerce, and is one of the most important railroad centers of the country, more than 30 lines intersecting there. It has very large manufactures of a varied character; among the more prominent are iron and steel, clothing, furniture, and agricultural implements. Slaughtering and meat-packing is among the most prominent of its industries. The city covers an area of 180 sq. m. Ab. one-fourth of its streets are paved, mainly with wood. Water is supplied by pumping from Lake Michigan, the point of supply being at some distance from the shore. It has a comprehensive sewer system, the sewers emptying into C. River. The sewage thus accumulated in the river and harbor causes much anxiety and trouble, and a project is in process of carrying it into the Illinois River. The population in 1890 was 1,099,850, of which fully one-half were of foreign birth. Marquette visited the place 1673; Fort Dearborn was built 1804. The city was laid out in 1830, and chartered 1837. Its growth has been phenomenal in its rapidity. Oct. 8–10, 1871, it was visited by a fearful conflagration, which destroyed the entire business center and a large part of the residence portion, involving a loss of $200,000,000. A bomb, thrown by Anarchists, May 4, 1886, killed 8 and wounded 60 policemen; 4 of the Anarchists were hanged Nov. 11, 1887, and others imprisoned. The Columbian Exposition was held May 1 to Oct. 30, 1893.

Chicago Ship Canal. Under construction to connect Lake Michigan with the Mississippi R., and to carry the sewage of Chicago away from the city and lake. The canal proper will be ab. 30 m. long, from 110 to 210 ft. wide, and from 22 to 36 ft. deep, 10 m. being in solid rock. Work was begun 1893. The estimated cost, including harbor outlet and river improvements, is ab. $28,000,000. It has a pitch of 1 ft. in 7 m., and will discharge 300,000 cubic ft. a minute.

Chicago Theological Seminary. Congregational; opened 1858; has 8 professors, 11 instructors and lecturers, and ab. 200 students in English, German and Scandinavian departments.

Chicago, UNIVERSITY OF. The first institution of this name was chartered 1857 and ceased to exist 1886. The present University was incorporated Sept. 1890, the first subscription, of $600,000, being that of John D. Rockefeller, who has since increased his gifts to over $4,000,000. The total property already exceeds $6,500,000. The pres. and two-thirds of the trustees must be Baptists. Instruction began Oct. 1892. The site covers 25 acres. The dormitories are intended to accommodate 2,000 students. It is always in session, the college year being divided into 4 quarters, and attendance required for any three. It comprises graduate schools of arts and literature, schools of science, divinity, law, medicine, technology, fine arts, and music, the last five not yet in operation. There is also a department of "university extension," designed to meet the wants of non-residents. The libraries contain 260,000 volumes. In 1894 there were 162 professors and 1,100 students.

Chickahominy. River of Va., tributary to the James; scene of battles in June, 1862. See FAIR OAKS and GAINES' MILL.

Chickamauga, BATTLE OF. Sept. 19–20, 1863, 12 m. e. of Chattanooga, Tenn., Gen. Bragg attacked Rosecrans, and after severe fighting routed the Federal right and center; but Thomas, with the left, repulsed the Confederates, and earned the title "Rock of Chickamauga." Confederate loss was 18,000, Union loss 16,000 and 36 guns. This was the most desperate and critical western action of the war: its result was disastrous to the South, for Bragg's plans were foiled and e. Tenn. held by the Federals. National parks were established here and at Chattanooga by an act of Aug. 1890.

Chickara. See ANTILOPIDÆ.

Chickasaw Bluffs. Near Vicksburg, Miss.; unsuccessfully attacked by Gen. Sherman Dec. 29, 1862.

Chickasaw Nation. One of The Five Civilized Tribes of the I.T., owning 7,267 sq. m., pop. 57,329, of whom only 6,800 are tribal Chickasaws. Originally of Muskhogee stock, they lived in n. Ala. and Miss.

Chicken Cholera. Very fatal disease of fowls of microbic origin in which there are enlargements of the glands and ulceration of the digestive organs; not found in the U. S.; source of great losses in Europe. By the successful treatment and prevention of this disease by inoculations with its modified virus, Pasteur gained a very considerable reputation.

Chicken-Pox. Contagious, febrile, eruptive disease, rarely attacking those above ten years of age, and by itself almost never fatal. Successive crops of small vesicles filled with a clear fluid appear upon the head and body, occasionally leaving small scars. It is erroneously believed to inflict permanent injury upon the sight.

Chickweed. Species of the genera *Alsine* and *Cerastium*. Low plants of the natural family *Caryophyllaceæ*, widely distributed.

Chickweed, FORKED. *Anychia dichotoma*. Insignificant plant of the natural family *Caryophyllaceæ*, native of e. N. America.

Chickweed, INDIAN. See CARPET-WEED.

Chickweed, JAGGED. *Holosteum umbellatum*. White-flowered plant of the natural family *Caryophyllaceæ*, native of Europe, sparingly introduced into the U. S.

Chickweed, MOUSE-EAR. Herbs of the genus *Cerastium*, of the Pink family; of wide geographical distribution. Several species are frequent as weeds.

Chickweed Wintergreen. *Trientalis americana*. Small plant of the natural family *Primulaceæ;* native of N. America; known also as Star-Flower.

Chicopee. City of Hampden co., Mass., on e. bank of the Connecticut. It has manufactories of cotton, cutlery, farming implements, and ordnance. It was settled 1640, incorporated as a town 1848, and as a city 1890. Pop. 1890, 14,050.

Chicory, or SUCCORY. *Cichorium intybus*. Plant of the Composite family, native of Europe and naturalized in N. America; cultivated for its roots, which are ground and mixed with coffee as an adulterant, and sometimes used as a substitute.

Chicory (*Cichorium intybus*).

Chief. Ranking officer of a corps or body of army officers, on whom additional or special duties devolve by virtue of his position; as, *Chief of Engineers, of Ordnance, Chief Commissary of Subsistence*, etc. *Chief of Staff*, though not provided for in time of peace by the Army Regulations, is appointed by a commanding general of an army during war.

Chief-Justice. Presiding judge: in Gt. Britain, of Queen's Bench Division of the High Court of Justice; in the U. S., of the Federal Supreme Court, and of the court of last resort in some of the States.

Chief of Asia, or ASIARCHS. Wealthy citizens of w. Asia Minor, presidents of the public games; mentioned Acts xix. 31.

Chiger, or CHIGOE. Sand-flea or jigger, *Pulex penetrans*. Minute tropical insect which burrows into the skin of the feet, causing swelling and suppuration. See APHANIPTERA.

Chi-Hwang-Ti, d. 210 B. C. Emperor of China from 246 B. C.; vigorous but despotic. He destroyed most of the Chinese writings, and executed nearly 500 men of letters.

Chilblain. Superficial inflammation of the skin, not unlike erisypelas, commonly affecting the toes and fingers, and due to exposure to cold. It occasionally leads to ulceration, and is best treated by applications of iodine.

Child, FRANCIS JAMES, LL.D., b. 1825. Prof. Harvard since

CHINA
Geographical Miles, 60 = One Degree
0 50 100 200 300
English Miles, 69 = One Degree
0 50 100 200 300
MONGOLIA
TIBET
BURMAH
KASHGARIA
KOKONOR
SUNGARIA
CHINESE TARTARY
CHINA
YELLOW SEA
EAST SEA
OR WHANG-HAI
TONG-HAI
Liaotong Gulf
Talien Bay
Neu-chwang
Seul or King-ki-tao
Yang-tsze-kiang
(North Entrance)
(South Entrance)
Hang-choo Bay
Ning-po
CHUSAN
CHUSAN ARCHIPELAGO
Shang-hae
Woosung
Nimrod Sd.
San-moon Bay
Thi-choo Bay
Wen-choo Bay
Hoang-ho (former Mouth)
Sand Banks
YOO-CHOO I.
QUAELPAERT
COREAN ARCHIPELAGO
LINDSAY I.
Basil B.
HALLS IS.
MI-A-TAU IS.
Cheefoo Har.
Shan-tung Pt.
Pt. Melville
LOO-CHOO ISLANDS
GT. LOO-CHOO
Napakiang
NAN-KUAN I.
CHEE-YANG-PAU I.
CHAI-TAN I.
Pelou Pt.
MAJICO-SIMAH IS.
TY-PIN-SON
KUKIEN
PA-CHU-SAN
TROPIC OF CANCER
Formosa Channel
FORMOSA
Pt. Kelung
Takau
South C.
BASHEE IS.
Struthers, Barrow & Co., Engr's., N.Y.

1851. His collection of *English and Scottish Ballads*, 8 vols., 1857–8, enlarged 1882 and later, is by far the best work in that field.

Child, Sir Josiah, 1630–1699. English economist of the so-called Mercantile School. *Trade and the Interest of Money*, 1668–90.

Child, Mrs. Lydia Maria (Francis), 1802–1880. American reformer and author; ed. *Anti-Slavery Standard*, 1840–43; *Philothea*, 1835.

Child, Theodore, 1847–1892. Anglo-American traveler, journalist, and author. He died in Persia.

Childers, Hugh Culling Eardley, F.R.S., b. 1827. M.P. from 1860; member of several cabinets.

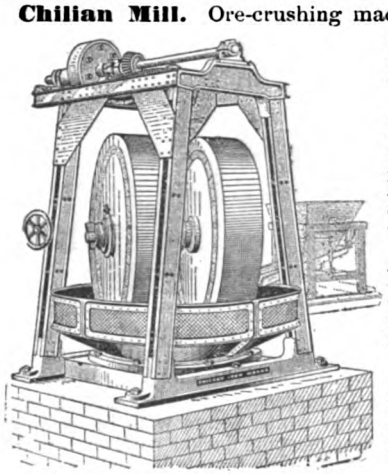
Childers, Robert Cæsar, 1838–1876. English Orientalist, author of a Pali dictionary.

Children, Prevention of Cruelty to. Organizations to protect children against the cruelty of parents and guardians and the inhuman demands of employers are of very recent growth. In England the Factory Acts and kindred legislation regulated juvenile labor; but the Society of which Elbridge T. Gerry is president, started 1875 in New York, was the first to deal with parental abuse. In 1891 this Society obtained 2,761 convictions and rescued 3,683 children, relieving 1,697 others. There are now 13 similar societies in New York, 14 in Ohio, 10 in Indiana, and ab. 70 in other States. There are also foreign Societies in many of the large towns of Great Britain and Canada and in the British colonies. The *Société protective de France* has branches at the large manufacturing centers; and other Societies exist at Milan, Madrid, Puerto Rico, Havana, St. Thomas, Bogota, etc.

Childs, George William, LL.D., 1829–1894. American publisher; owner Phila. *Ledger* from 1863. His public and private benefactions were numerous.

Chili. Republic of S. America, between the crest of the Andes and the Pacific, from Cape Horn to 16° 30′ s. lat. Length ab. 2,300 m.; average breadth ab. 130 m.; area ab. 293,970 sq. m. Most of the country is mountainous, consisting of the western slopes of the Andes, which leave but a narrow strip of level land along the coast. It is mainly deficient in rainfall, but has a great extent of sea coast, on which are several fine harbors. It has great mineral wealth, a fertile soil and a large commerce. Its railroads had an extent in 1890 of 1,700 m. The capital is Santiago; Valparaiso is the leading seaport. The Araucanians, who still occupy the s. part, repelled Almagro 1535, and were troublesome till 1722, though Valdivia had acquired most of the country by 1550. It was a Spanish viceroyalty till 1810: the war of independence ended 1826. The constitution of 1824 was revised 1833. War with Bolivia and Peru, 1879–83, resulted in an extension of territory. Pres. Balmaceda, aiming at arbitrary power 1888, was opposed by Congress and the navy and overthrown 1891: this contest threatened to involve the U. S. Pop., in 1892, 2,867,375.

Chilian Mill. Ore-crushing machine, in which the work is accomplished by the rolling of heavy wheels over the ore.



Chilian Mill.

Chili Saltpeter. $NaNO_3$. Sodium nitrate, found in beds in n. Chili and neighboring districts. It is an important article of export, and finds wide use in the arts.

Chillianwalla. Village of the Punjab, India; scene of Lord Gough's victory over the Sikhs, Jan. 13, 1849.

Chillicothe. City of Ross co., Ohio, on right bank of Scioto River; capital of Ohio 1800–10. Pop., 1890, 11,288.

Chillingworth, William, 1602–1644. English divine, R. C. 1630–1. *Religion of Protestants*, 1638.

Chillon. Castle at e. end of Lake Geneva, long a prison; celebrated in Byron's *Prisoner of Chillon*. See Bonnivard.

Chills and Fever. Fever of malarial origin, more particularly intermittent fever.

Chilognatha (Millipedes, or Thousand-legs). Myriapods with nearly cylindrical body. Each segment, except the anterior ones, bears two pairs of legs. The antennæ have only seven joints, the mouth parts are adapted to masticate vegetable substances, and the genital openings are on the coxal joint of the second pair of legs. *Iulis* and *Glomeris* are examples.

Chilon, 6th century B.C. One of the seven sages of Greece.

Chilopoda (Centipedes). Order of *Myriapoda*, characterized by a flattened body, each joint of which carries but one pair of legs. The head bears a pair of long, many-jointed antennæ, and strong insect-like biting jaws. The segment just back of the head bears the poison glands in a pair of large appendages that terminate in perforated hooks. In the tropics centipedes may attain a foot in length and secrete enough poison to make a dangerous bite. *Scolopendra* and *Lithobius* are examples.

Chilostomata. *Gymnolæmata*, the aperture of whose cells can be closed by an operculum or a sphincter muscle. Avicularia, vibracula and ovicells are often present. *Cellularia* (*Cellularina*) forms branched colonies; *Membranipora* (*Flustrina*) forms encrusting colonies. In *Retepora* (*Celleporina*) the colony forms a reticulum. *Escharina* is a fourth group, of which *Eschara* is typical.

Chilostomellidea. Order of perforate *Foraminifera*, with calcareous shells consisting of many chambers, attached to each other in straight lines, new chambers being added in one, two, or three directions. The end chamber has a curved slit-like opening.

Chiltern Hundreds. In Buckinghamshire. Their stewardship, once designed for protection against robbers, is now a merely nominal office, to which every member of Parliament must be appointed before he can resign his seat.

Chimæra. Monster in Lycia, which vomited fire; in front a lion, in the hinder part a dragon, and in the middle a goat; slain by Bellerophon; named perhaps from a volcano in Lycia, Asia Minor.

Chimæra. A shark of peculiar appearance present in the Northern seas. It is ab. 3 ft. long and of a white color, spotted

Chimæra monstrosa.

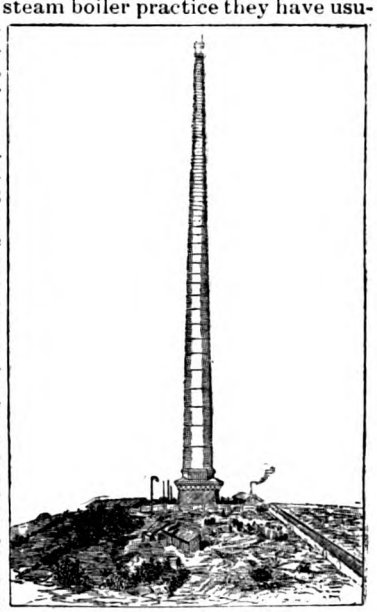
with brown. In the U. S. it is known as the Sea Cat; in Gt. Britain as King of the Herrings. See Holocephali.

Chimborazo. Peak of the Andes, in Ecuador; ht. 20,496 ft.

Chimere. Black (formerly scarlet) satin vestment of a bishop.

Chimney. Body of ore extending downward in a vein, usually at a steep angle, but without great extension in any horizontal plane.

Chimneys. Vertical flues to remove hot or foul gases and products of combustion. In steam boiler practice they have usually a cross-section of one-eighth the grate area discharging into them. Draft is caused by the greater weight of the column of cold air outside the chimney and of the same height. Experience has shown that a chimney 50 ft. high will burn 13 lbs. of coal under a steam boiler per sq. foot of grate per hour, and that each 10 ft. of added height will burn from 1.1 to 1.4 lbs. additional per foot of grate, up to 120 ft. in height (see Artificial Draft). Chimneys are built of brick or iron lined with brick, or of brick with an iron skeleton, or of iron alone. Usual sections are round, square, or star-shaped. Many have an inner lining not bonded to the outer shell, so that unequal expansion shall not tend to wreck the structure. High chimneys are designed to resist a horizontal wind pressure of 40 to 50 lbs. per sq. foot. The



Chimney at Halsbrucke.

highest chimney in the world is at Halsbrücke in Saxony: the base is 40 ft. sq. and 28 ft. high, and the chimney shaft on this is circular with an inside diameter of 15.7 ft.; the height is 453 ft. At Kearney, N. J., is a chimney 335 ft. high.

Chimpanzee. See TROGLODYTES NIGER.

China. Empire of s.e. Asia, embracing, besides China proper, Manchuria, Mongolia, and Thibet. The entire area is estimated at 4,414,000 sq. miles and its population at 410,000,000. China proper contains about 1,337,000 sq. miles and a pop. of 387,000,000, an average of about 289 inhabitants per sq. mile. There are 10,000 resident foreigners, chiefly at the 23 treaty ports. The capital is Peking. The greater part is mountainous, the mountains being highest in the w. and n., diminishing in elevation toward the coast, much of which is low, alluvial, and subject to inundation from floods in the rivers. The principal of these are the Yang-tse-Kiang and the Hoang Ho; besides these, several others are navigable for long distances. The soil is fertile and is cultivated with the utmost economy. Rice is raised in the south, and wheat, barley, maize and millet in the north. Opium culture is increasing, and sugar is produced in Formosa and the south. Tea is exclusively cultivated in Formosa and s. and w. provinces Fu Chien, Hu-pei, Hu-Nan, Chiang-ksi, Cheh-kiang, An-hui, Kuangtung and Szech'wan, the four last also producing the best silk, though the mulberry grows everywhere. Coal is found in every province, but so far mines have only been worked under foreigners at Kai-p'ing, Keelung and Hankow. Iron and copper are plentiful but little worked. Manufactures are very extensive and varied; and, since the opening of certain ports in 1860, its foreign commerce has become of considerable magnitude. The imports (1892) amounted to $122,625,468, exports $123,079,360. Of the imports one-half consists of cotton goods and one-quarter of opium, while tea amounts to one-third and silk to half the exports. The total revenue of the government, consisting of customs, transit-levy, licenses, rice-tribute, land and salt taxes, is estimated at ab. $79,000,000.

It is governed by the Emperor and supreme council called Chun Chi Chu. The administration is by the Nei-ko, a cabinet of two Manchus and two Chinese assisted by two members of the Han-lin (Great College), who see that nothing is done in violation of the sacred books of Confucius. Under these ministers are the seven government boards of civil appointments, revenues, rites and ceremonies, army, public works, criminal jurisdiction, and admiralty. Each of these has a Manchu and a Chinese president.

The army consists of the Eight Banners, numbering 323,000, of which 100,000 are reviewed at Peking once a year, and the National Army of ab. 650,000. The war of 1894 showed that this army only existed on paper, not one-tenth being brought into the field. The fleet, which was almost entirely captured or destroyed, consisted of 9 battleships, 9 port-defense vessels, 56 cruisers and 41 torpedo boats.

Internal communication is by means of bad roads and innumerable good canals and rivers: there is not 50 m. of railroads in the whole empire.

The early ancestors of the Chinese came from the westward, and settled in Shansé, displacing the aboriginal inhabitants. Confucius begins his history with the reign of Yaou, 2356 B.C.; but the Chinese believe that more than two million years had then elapsed since the creation of men in China. Yaou was a virtuous ruler; established marts, and fairs. The Shang dynasty succeeded his, 1766 B.C., and then the Chow followed. Woo Wang, its first emperor, divided the empire into 72 feudal States. The Tartars, of whom we first hear ab. 936 B.C., took advantage of the internecine warfare that ensued to make raids into the country. The Wang dynasty arose 255. Its most illustrious emperor, Chi-Hwang-ti, constructed roads, built canals, and began the long wall as a defense against the Tartars. To protect himself against the unfavorable comparisons made by the enemies of change he ordered the destruction of historic books. The Han dynasty arose 206, inaugurating a period of literary activity; many books were restored. The Eastern Han dynasty began 23 A.D. Buddhism was introduced from India 65. From 220 began a period of division and warfare, interrupted only by the reign of Woo, 265, till the Suy dynasty was founded by Yan Keen 590, who reigned with undivided authority. Under the Tang dynasty, 617-907, regarded as the golden age of literature, the empire extended to the Caspian. Ambassadors came from Rome; Nestorian missionaries found favor. Under the empress Woo How, the Thibetans and the Khitans in the n. e. suffered defeat, but their raids continued. Other dynasties followed in rapid succession. The Kin Tartars were invited to aid in expelling the Khitans, and having done so, remained, advancing their empire to the Yang-tse-Kiang. Ab. 1150 the Mongols, under Jenghiz Khan, invaded the n. w. and defeated the Kin. Under Ogdai, successor of Jenghiz, the Kin emperor was besieged, and burned himself in his palace. Mangu Khan succeeded 1248, and Kublai 1259. During his reign Marco Polo visited China. The Mongol dynasty was overthrown 1368, and the Ming, a Chinese, established. The Manchoos began their invasions 1616. Meantime rebel bands, enriched by plunder, increased in numbers and power, overrunning province after province, till finally the gates of Peking were opened to them. The emperor committed suicide. The Manchoos, being invited to dispossess the rebels, took Peking, but proclaimed their own emperor as head of the Ta-Tsing dynasty. Thibet was added to the empire, which now extended from Siberia to Cochin China, and from the China Sea to Turkestan. Under Keen-Lung, 1755–95, troubles began with the East India Co. War was declared by England 1840 on account of the opposition made by China to the importation of opium. As a result, four new ports were opened to foreign trade. The Tae-Ping rebellion broke out during the reign of Heen-Fung, 1850–59. Its leader declared himself a Christian, and professed to be called of Heaven to restore the Chinese power. He gained many followers, and soon took Nanking. War broke out again with England 1857, ending in a treaty, and payment of large indemnity by the Chinese. Gen. Gordon now took the field against the rebels, and in July 1864 the imperialists re-entered Nanking. In 1875 Kwansen, not yet four years old, the present Emperor, came to the throne. Christianity has made some progress during the last 30 years; the telegraph and the railroad have been introduced to a very limited extent.

The war with Japan 1894–5, originating in Corea, was disastrous on sea and land, and ended by the treaty of Simonoseki. Japan received Formosa and the Pescadores, the Liau-Tong Peninsula, and $200,000,000 indemnity. The independence of Corea was also recognized. By the intervention of Russia, France and Germany all continental territory was renounced for an additional $100,000,000, Port Arthur and Wei-Hai-Wei alone being retained until payment. See MANCHU INVASION.

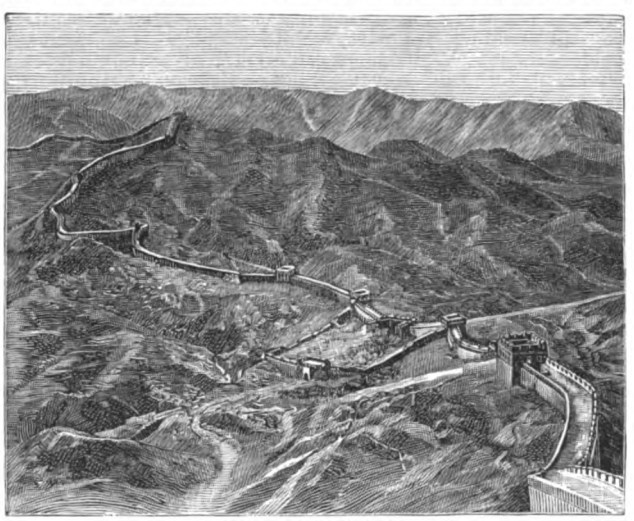
China Blue. See COTTON BLUE.

China Clay. See KAOLINITE.

China Grass. See RAMIE.

China Sea. Part of the Pacific, bet. the mainland of Asia and Borneo and the Philippine Islands.

China, WALL OF. Barrier begun 214 B. C. by the Emperor Chi-Hwang-Ti, to protect the empire from invasion by the northern barbarians; ab. 25 ft. wide at base and 15 at top,



Great Wall of China.

varying in ht. from 15 to 30 ft. The sides are of granite (at bottom) and brick, the interspace being filled with earth and rubble. Length ab. 1,500 m., in a straight line 1,255 m.

Chinch Bug. *Blissus leucopterus.* Sucking insect one-seventh inch long, black, with white wings with black spot. Young are yellow and wingless, become darker with each molt. Two or three broods per season. One female lays 500 eggs on roots of wheat, etc. Flourish in warm dry season. In wet season are attacked by fungus (*Sporotrichum globuliferum*) which may be artificially introduced with beneficial results. When on the march a trench into which petroleum has been poured will stop them. A false chinch bug (*Nysius augustatus*) resembles true chinch bug in size and odor, is brown (wings not white), attacks mustard, turnips, radishes, etc. Use petroleum emulsion.

Chinchilla. *C. lanigera.* Small S. American rodent inhabiting the high mountain valleys. They are ab. 1 ft. long, with thick bushy tail, and nocturnal in their habits. Their gray fur is prized for its remarkably fine texture. See HYSTRICOMORPHA.

Chinchon, Ana, Countess of, 1576–1639. Twice vice-queen of Peru; first to introduce Peruvian bark into Spain. Cinchona (q. v.) was named from her.

Chinese Immigration. The coming of Chinese into California began soon after the discovery of gold 1849. Opposition soon sought expression in attempts to restrict them by local legislation. This was declared invalid by the U. S. Supreme Court, and an attempt was then made to enact a Federal law on the subject. In 1879 a bill was passed by both Houses, limiting the number of Chinese passengers brought by a vessel to 15. This was vetoed by Pres. Hayes as contrary to treaty stipulations, but a committee was subsequently appointed to negotiate a treaty with China giving to the U. S. the power to limit or regulate, but not to prohibit, the coming or residence of Chinese laborers, and to secure also to Chinese students, teachers, merchants, travelers, and laborers the right to come and go at pleasure, and the right to the privileges accorded to citizens or subjects of the most favored nations. This treaty was ratified by the Senate in March, 1881. It is asserted that the Chinese are an inferior race, incapable of understanding our political institutions or entering into our social life. On the other hand, they are said to be models of industry, thrift and docility. Doubtless one of the strongest reasons for opposing their coming is their willingness to work for very low rates, thus becoming formidable competitors for employment with other laborers.

Chinese in America. They all come from the Departments of Kwangchau and Shauking in the Province of Kwantung. They describe themselves as Púntí or Natres, as distinguished from the tribes called Hákká, and divide themselves into the people of the Sam Yup, Three Towns, and the Sz' Yup, Four Towns or Districts. The tract from which they come is little more than 100 miles sq., high and mountainous in the n. and w., while the coast is low, and studded with small islands. The people of the different districts show distinctive peculiarities in speech and customs. Those from Nánhai and Pw'anyú, the districts including Canton, agree in general with the people of the capital, and their language differs little from that of the city, as transliterated by Dr. S. Wells Williams (*Tonic Dictionary of the Canton Dialect*). The emigrants are much influenced by home traditions, and those from the same section keep together. They establish separate shops, when their numbers warrant it, as well as assembly-rooms and guild-halls. The Six Companies in San Francisco, under which nearly all the Chinese in the U. S. are enrolled, are such guilds, formed by emigrants from different parts of the province. They exercise no authority over their members, and there is little intercourse or sympathy with the consular and diplomatic representatives of the Chinese government. The ties of kindred, preserved with so much care in China, are recognized here, and many of the immigrants claim relationship. Some 30 or 40 clans are represented; those bearing the names of *Li* and *Múi* preponderate. On the completion of the Union Pacific Railway thousands of Chinese were thrown out of employment. In the absence of women in the mining camps, they found a remunerative occupation in the laundry business, and before 1869 they obtained almost a monopoly of that occupation in the West. Their establishment in the East dates from 1869. They have colonies in all the larger American cities, their shops, restaurants, gambling-houses and shrines usually being located in adjoining buildings in the poorer quarter. The shops are the centers around which they organize, frequently going so far as to create a kind of self-government. Next to their almost universal employment in washing clothes, gambling is their chief avocation, being regularly carried on by organized companies. In their settlements may be found tailors, carpenters, painters, and various other artisans, as well as barbers, physicians, and fortune-tellers. There are no priests of any of the recognized religions of China in their temples, except in San Francisco. Their public worship consists in praying and making offerings before the shrine of the God of War, the divinity commonly appealed to. He is chiefly resorted to by those who desire to learn the future by the aid of divination. Their religious belief is a mixture of Buddhism and Taoism, with certain other native elements, while their theory of morals is based upon the Confucian writings. In general, they have had more or less training in native schools, are peaceable, and extremely industrious; not as thrifty as some other classes of immigrants, fond of luxurious living, and willing to give an equivalent in labor for all they receive.

Chinese Language. Monosyllabic, analytic language, without inflections, and dependent for meaning, as well as for syntactical purposes, upon the variety of verbal arrangement, peculiarity of accent, and addition of certain words. There are many dialects, and the language is spoken by perhaps 400,000,000 people. As a written language, it is capable of exact expression, and has a venerable literature.

Chinese Literature. Arranged under four divisions: 1. Classics; 2. Histories; 3. Philosophy and the Arts; 4. Poetry and Polite Literature. The Classics form the stem from which the others are said to spring. They comprise the Book of Divination, the Book of History, the Book of Odes; the Rituals, of which two principal texts survive from antiquity; and the Spring and Autumn Annals (the only one of the Classics actually written by Confucius). Several other works, known collectively as the "Four Books," and including the Analects of Confucius and the writings of Mencius, are also called classical. A series of dynastic histories, the first of which was written in the 1st century B.C., extend to the present line. Vast collections exist of works on lexicography, divination, astronomy, medicine, war, geography, and the fine arts. Philosophical writings consisting chiefly of expositions of the Classics and treatises on Buddhism and Taoism, are supplemented by an enormous popular literature, made up largely of romances. The cyclopedias, which embody many important works otherwise lost, are of great antiquariam value.

Chinese Music. Though sounding crude and noisy to Occidental ears, it has a history authentic and traditional, reaching back to the conquest of the country by Hoang-ti, 2637 B.C., and a voluminous theoretical literature. As an essential element in the drama, it still preserves the purposes set for it by the Greeks (see Lyric Drama), and no play is complete without it. With the dance, it is also a necessary adjunct of the Confucian religious service. Chinese melodies are based on a five-note scale, the diatonic scale of Western music with the fourth and seventh tones omitted, thus: f, g, a, c, d, and in this show affinity with old Celtic music. Harmony is unused except when it results from twanging all the strings tuned in fourths or fifths on instruments of the guitar kind at the close of pieces.

Chinese Secret Societies. Apparently the direct outgrowth of the clan system. The most important, which flourishes in s. China and has branches in the Chinese colonies in various parts of the world, is political, aiming to overthrow the present dynasty and restore that of the Mings. According to its own records, it dates from ab. 1620. Its general name is *T'in Ti ui*, or "Heaven-Earth League." Among the Chinese in the U. S. it is known as *I Hing*, or "Righteous Rising," from the name of the Canton lodge. This society, which is vigorously suppressed by the government in China, practically dominates the Chinese in their foreign settlements. Its ceremonies resemble those of the Freemasons, and its members are popularly known as Chinese Freemasons. The traditions of the Chinese Society embody certain cosmical notions, possibly inherited from some older society, which are common to men everywhere.

Chinese White. Oxide of zinc, first introduced as a substitute for white lead as an artist's pigment in 1796: in general use since 1844.

Chinghis Khan. See Jenghiz Khan.

Chinook. Indian Jargon used for trade purposes on the Pacific coast. The vocabulary contains ab. 480 words, including 200 Chinook, 90 French, 67 English, and the remainder taken from other tribes. The advantage of having a common patois was quickly perceived by the Indians, and it soon became used between different tribes, as well as between them and the whites. Notwithstanding its limited vocabulary and absence of inflexions it serves every purpose of ordinary intercourse. It originated with the 18th century fur traders.

Chinookan Indians. Tribe formerly living on the Pacific coast about the mouth of the Columbia R. and extending ab. 200 m. along its course. They lived principally by fishing and numbered ab. 1,800 when first observed and described. They are now reduced to ab. 500 on reservations in Washington and Oregon.

Chinook Winds. Warm, dry, strong, s. or s.w. winds, first observed in Washington in the valley of the Columbia R. or the country of the C. Indians, sometimes included in the Föhn winds.

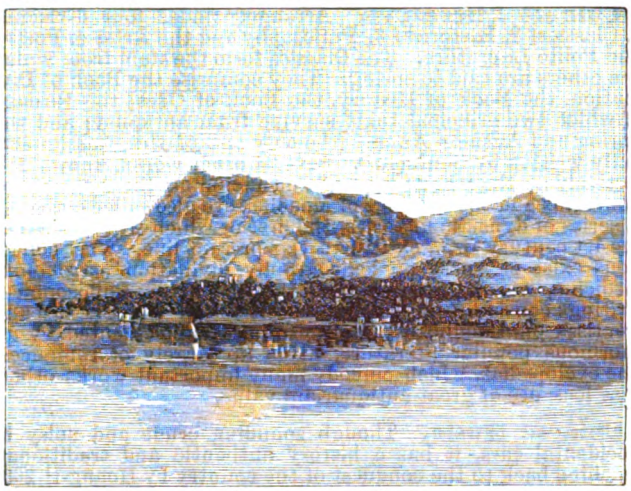
Chinquapin. *Castanea pumila.* Shrub, nearly related to the chestnut, native of the s.e. U. S.

Chinquapin, Water. See Nelumbo.

Chintz. Cotton fabric highly glazed and printed with flowers and patterns in varied colors; largely used for furniture covers.

Chios (now Scio). Island in Ægæan Sea off the coast of Lydia; colonized by Ionians; ravaged by Persians 499 B.C., by

Athenians 412 B.C.; conquered by Crusaders 1204, and in 1566 by Turks, who massacred or enslaved most of its inhabitants in



Chios—Town and Island.

1822. 6,000 perished in an earthquake April, 1881. Pop. 70,000, mostly Greeks.

Chipman, DANIEL, LL.D., 1765–1850. Prof. of Law in Middlebury Col., Vt., 1806–16; M. C. 1815–17. *Law of Contracts*, 1822; *Vt. Reports*, 1824.—His brother, NATHANIEL, LL.D., 1752–1843, was U. S. District Judge for Vt. 1791–93; Chief-Justice of Vt. 1789, 1796, and 1813–15; U. S. Senator 1797–1803; Prof. of Law at Middlebury 1816–43. He revised the laws of Vt. 1826, and pub. *Principles of Government*, 1793.

Chipman, WARD, LL.D., 1787–1851. Judge of New Brunswick, Canada, 1824; chief-justice 1834. *Reports*, 1849.

Chipmunks. Ground squirrels of genus *Tamias*. They have well developed cheek pouches and dark stripes on a light background along the back. The tail is flat and bushy, two-thirds as long as the body. The larger species are nearly a foot long, and live in the Rocky Mountain region.

Chippewa. Canadian village, on Niagara R.; scene of a victory of U. S. troops over British, July 5, 1814.

Chippewa River. Left hand branch of the Mississippi, in Wis. Length 165 m., drainage area 8,892 sq. m., mean flow 3,872 cubic ft. per second.

Chippewas. Indian tribe of the Algonquin family whose hunting grounds were formerly in Mich., Wis. and Minn. Constantly at war with their neighbors, they joined the English at the Revolution and in 1812. They are now on reservations, in Kan. 75, Minn. 6,378, Wis. 4,778, and N. D. 1,458. Besides these there are 7,700 citizen Chippewas.

Chiromancy. Hand-divination, the science of astral influence as revealed by the lines of the palm, is of extreme antiquity, holding an important place in the occult studies of Jews, Chaldeans, Assyrians, Egyptians and Hindus. Attention was also paid to it by Greek and Roman philosophers and mediæval scholars, Plato, Aristotle, Ptolemy, Albertus Magnus, Avicenna, Averrhoes, Taisnier and Belot. The persecution of witchcraft and necromancy discredited chiromancy, none but gypsies and charlatans practicing it until the works of D'Arpentigny (1843) and Desbarrolles (1859) restored it to fashion.

Chiron, or CHEIRON. Wisest of the Centaurs; skilled in hunting, medicine, music, gymnastics and the art of prophecy. Many of the Greek heroes were his pupils.

Chiroptera. See CHEIROPTERA.

Chitin. Horny substance making up most of the shell of *Crustacea*, and especially insects.

Chiton. See PLACOPHORA.

Chittenden, THOMAS, 1730–1797. First Gov. of Vt. 1778, and 17 times re-elected.—His son MARTIN, 1769–1841, was M. C. 1803–13, and Gov. of Vt. 1813–14.

Chittim. Hebrew name for the Mediterranean islands, especially Cyprus.

Chitty, JOSEPH, 1776–1843. English lawyer and prolific author. His most important works are *Bills, Checks and Notes*, 1799; *Pleading*, 1808; *Criminal Law*, 1816; *Practice*, 1831–38.

Chiusi. Anciently Clusium. Etruscan town whose tombs have furnished many of the treasures now in the Vatican. Important mural paintings are still to be seen here, also an Etruscan museum. Pop. ab. 5,000.

Chivalry. Modern game of skill, played by two persons upon a board marked with squares, with 40 pieces; each player having eight knights and 12 men, the pieces on opposite sides being distinguished by their color. The object of the game is to get two pieces across the board upon two designated squares on the adversary's side.

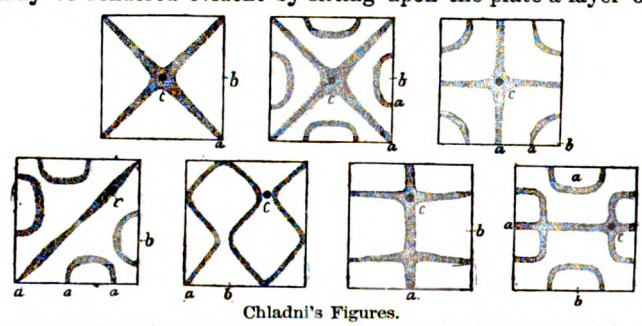
Chivalry, AGE OF. Ab. 1,000–1,500; age of the armored horseman, of the nobleman in his castle and the serf in his hut; of force and Feudalism. Chivalry was the redeeming factor of this age; it restrained violence, softened manners, and maintained an ideal standard of honor, fidelity and justice which partly made good the loss of public order and general government. Its origin is traceable to Teutonic delight in arms and personal loyalty. It became a complete system with its code of laws, definite aims, and ceremonial of initiation and degradation. The training of the knight occupied 7 years, first passing through the grades of page and squire. From the custom of the newly dubbed knight going forth to try his metal, arose knight-errantry, the practice of roaming abroad to defend the weak and avenge the oppressed. Its most brilliant phase, the tournament, determined the method of warfare of the age, which was a mere contest of strength between horsemen encased in armor. The Crusades were its crowning military achievement. The invention of gunpowder was its undoing. It overspread all Europe, and reached its highest perfection in France. Its virtues were gentleness, bravery, courtesy, truthfulness, hospitality, generosity, fidelity; it went to fantastic excess in its adoration of the ladies. Its dark side was the aristocratic spirit which it fostered, the excessive delight in war and the chase, its contempt for labor, and its love of personal display; but it greatly contributed to the elevation of woman, fostered a lofty conception of personal honor, and transmitted a general ideal of noble manhood.

Chives. *Allium schœnoprasum*. Onion-like plant, native of the colder parts of the n. hemisphere, sometimes cultivated in gardens.

Chizerots and Burins. Peculiar people, of supposed Moorish origin, found near Bourg-en-Bresse, e. France; shunned and despised by their neighbors, though well-conducted and thriving.

Chladni, ERNST FLORENS FRIEDRICH, 1756–1827. German, Doctor of Laws 1782, who later turned his attention to natural science and traveled over Europe lecturing on acoustics, thus founding that science. *Entdeckungen über die Theorie des Klanges*, 1787; *Die Akustik*, 1802.

Chladni's Figures. Nodal lines on a vibrating plate may be rendered evident by sifting upon the plate a layer of



Chladni's Figures.

a, points touched with finger; *b*, points along which bow is drawn; *c*, points where the plate is fixed.

fine sand. This is thrown from the ventral segments, but settles on the nodes, indicating in many cases very beautiful designs.

Chlænaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 7 genera and ab. 15 species, all natives of Madagascar.

Chlamydomonadaceæ. Order of unicellular green Algæ.

Chlamydophora. Order of *Heliozoa*, in which there exists a soft gelatinous or a felted envelope, as in *Heterophrys*.

Chlamydospore. Spore with thick walls, produced in certain of the lower Thallophytes.

Chlamys. Short mantle of the Greeks; a piece of cloth like a shawl, usually worn by attaching two corners together at the neck.

Chloanthite. Nickel arsenide allied to smaltite.

Chlodwig. See CLOVIS.

Chlopicki, JOSEPH, 1771–1854. Polish general, in the service of France 1797–1814, and of Russia 1814–18; dictator of Poland Dec. 1830.

Chloracetic Acid. $CH_2Cl.COOH$. Mpt. 62° C. Monochloracetic acid; white rhombic prisms, prepared by the action of chlorine gas on glacial acetic acid; strong acid, corroding the skin.

Chloral. $CCl_3.CHO$. Bpt. 98° C. Trichloracetaldehyde; liquid, formed by the action of chlorine upon common alcohol. It combines with great readiness with water, forming CHLORAL HYDRATE (q.v.).

Chloral Amide. $CCl_3.CH:\overset{OH}{\underset{NH}{}}.CHO$. Compound produced by the action of formamide upon chloral; colorless crystals, rather insoluble in water, with a bitter taste; used in pharmacy as a hypnotic.

Chloral Hydrate. $CCl_3.CH:(OH)_2$. Mpt. 57° C. White crystalline substance, formed by the combination of water with chloral. Sulphuric acid withdraws water with the formation of chloral. It is used largely as a hypnotic, but has a depressing effect upon the nervous centers, and is injurious to many. The habit of taking it is easily acquired, and abandoned with great difficulty.

Chloranil. $C_6Cl_4O_2$. Tetrachlorquinone; light yellow plates with quinone odor, formed by the action of chlorine upon quinone; also by that of hydrochloric acid and chlorate of potassium upon many organic compounds.

Chloraniline. $Cl.C_6H_4.NH_2$. Mpt. 75° C. Three forms are known, as ortho-, meta-, and parachloraniline. The latter is most important, and is prepared from parachloracetanilide by the removal of the acet group. White solid. The ortho and meta compounds are both liquid, and are prepared indirectly.

Chloranthaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 4 genera and ab. 37 species, distributed through the tropics of America and Asia; found also in e. Asia and the Islands of the Pacific.

Chloranthy. Reversion of flowers to green leaves, as in certain roses; called also Chlorosis.

Chlorastrolite. Greenish pebbles with stellate structure found on Isle Royale, in Lake Superior; formerly supposed to be a homogeneous mineral species. Hydrous silicate of aluminium, calcium, sodium and iron.

Chlorates. Salts of chloric acid, $HClO_3$, made by replacing the hydrogen by a metal.

Chlorauric Acid. $HAuCl_4+4H_2O$. Crystalline compound, obtained by evaporating a solution of gold trichloride in presence of an excess of hydrochloric acid.

Chlorbenzene. C_6H_5Cl. Bpt. 133° C. Monochlorbenzene; product of the action of chlorine upon benzene in the presence of iodine; liquid of agreeable odor.

Chlorcarbonic Ether. See ETHYL CHLORCARBONATE.

Chlor Compounds. Organic compounds derived by the replacing of hydrogen by chlorine. The chlorides are compounds whose name signifies a combination of a group with chlorine. See BROM COMPOUNDS.

Chlorhydric Acid. See HYDROCHLORIC ACID.

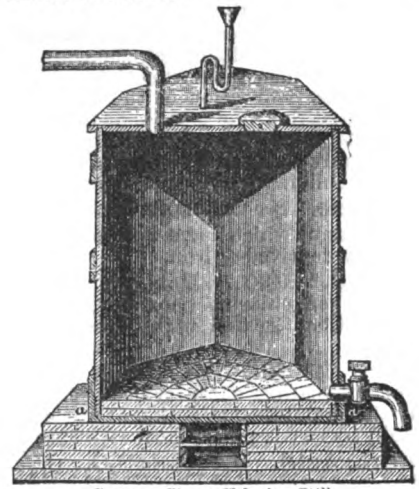
Chlorhydrines. Compounds formed from alcohols containing more than one hydroxyl group by replacing hydroxyl by chlorine. Thus from glycerol ($CH_2OH.CHOH.CH_2OH$) are derived mono-, di-, and trichlorhydrines.

Chloric Acid. $HClO_3$. Oily, unstable liquid, decomposing at 40° C.; strong oxidizing agent, made by treating barium chlorate with sulphuric acid.

Chloride of Lime. $CaOCl_2$. Common name for BLEACHING POWDER (q.v.)

Chlorides. Salts of hydrochloric acid, HCl, made by replacing the hydrogen with a metal; also, compounds formed by the union of chlorine with another element.

Chlorine. Cl. At.wt. 35.17, sp.gr. 2.45. Element discovered by Scheele 1774. It does not occur free in nature. It occurs in chlorides, common salt, sodium chloride, being its most important compound. It is isolated by decomposing hydrochloric acid with manganese dioxide. It may be made by heating salt, manganese dioxide and sulphuric acid. It is a greenish-yellow gas, of a suffocating odor and with great affinity for many of the elements. Water dissolves 2 vols. at 15.5° C. It is liquefied by pressure of 3.66 Atm., 0° C.; the liquid is yellow to orange, sp. gr. 1.47. It is solidified at —102° C. It is manufactured in large quantities for the preparation of bleaching powder, $CaOCl_2+H_2O$, which contains up to 43 per cent available chlorine. In this form it can be conveniently transported. It is used in the manufacture of certain aniline dyes, in that of chloroform, for bleaching and disinfection. See DEACON'S PROCESS, WELDON'S PROCESS.



German Stone Chlorine Still.

Chlorine Dioxide. ClO_2. Greenish-yellow gas, made by treating potassium chlorate with sulphuric acid. It is unstable, and supports combustion readily.

Chlorine Hydrate. Cl_2+10H_2O. Crystals, formed by passing chlorine into water cooled down below 0° C.; unstable.

Chlorine Monoxide. Cl_2O. Very unstable gas, which can readily be liquefied; made by passing chlorine over cold, dry mercuric oxide.

Chlorine Water. Made by passing the gas into water until it is saturated. It must be protected from sunlight.

Chlorite. Group of minerals, hydrous aluminum and magnesium subsilicates, greenish in color, lamellar in texture, and soft. Occur in crystalline schists, and in many cases are alteration products from amphibole.

Chlorites. Salts of chlorous acid, $HClO_2$.

Chloritoid. Hydrous aluminum and iron silicate, named from its resemblance to chlorite.

Chlorodyne. Proprietary preparation, used as an anodyne, narcotic, and in the treatment of diarrhœal disorders; said to contain morphine, ether, chloroform, and cannabis indica.

Chloroform. $CHCl_3$. Bpt. 61°C. Trichlormethane. Marsh gas or methane (CH_4) in which 3 atoms of hydrogen have been replaced by chlorine; heavy liquid with agreeable odor; prepared by the action of bleaching powder upon alcohol or acetone. Chloral is first formed and subsequently decomposed by calcium hydroxide. Used as a solvent and as an anæsthetic. It was discovered 1831 by Guthrie of Sackett's Harbor, N. Y., and nearly at the same time by Liebig and Soubeiran, and first used as an anæsthetic Nov. 1847 by Sir J. Y. Simpson of Edinburgh. It is less irritating to the lungs, and can be used in smaller quantities than ether, but is more dangerous, and should not be administered to persons with heart disease; it is more extensively used in Europe than in the U. S. See ANÆSTHETICS and SULPHURIC ETHER.

Chloroleucites. See CHLOROPLASTIDS.

Chloropal. $Fe_2Si_3O_9+5aq$. Soft, greenish, earthy mineral, resembling opal in appearance, but in composition a hydrous iron silicate.

Chlorophyceæ. Division of Algæ, including the light green or yellowish green kinds, as Sea Lettuce (*Ulva*), and the *Conferoideæ;* also called *Chlorospermeæ.*

Chlorophyll. Green coloring matter of leaves and plants; exceedingly unstable body of unknown constitution, containing carbon, hydrogen, nitrogen, oxygen, and perhaps iron. It occurs in the cells in the form of soft granules, and acts as an assimilating agent under the influence of light. It is unknown in Fungi.

Chlorophyllan. Green crystalline substance obtained by evaporating the alcoholic solution of green leaves.

Chlorophyllophyceæ. See PROTOCOCCOIDEÆ.

Chloroplastids. Grains containing chlorophyll, occurring in great abundance in all the green portions of plants. Alcohol dissolves from them the green matter and leaves the skeleton of protoplasmic matter. They are generally nearly spherical in form, and in some cases contain starch; also known as Chloroleucites.

Chlororufin. Yellow or orange pigment, soluble in alcohol, having then a strong odor of violets; contained in the cells of certain minute *Algæ* and *Protophyta.*

Chlorosis. Bleaching of green plants, caused by a deficiency of iron in the sap; also, the reversion of flowers to green leaves. See CHLORANTHY.

Chlorosis. Condition confined almost exclusively to females between the ages of 15 and 20, and connected with the establishment of the menstrual function; characterized by weakness, low spirits, palpitation of the heart, depraved appetite, disordered digestion, and a pallid or muddy complexion. When uncomplicated by disease of the heart and blood vessels or lungs, it is usually easily relieved by proper hygienic surroundings and the building up of the strength.

Chlorospermeæ. See CHLOROPHYCEÆ.

Chlorotic. Plants which have become entirely colorless by being artificially deprived of iron.

Chlorous Acid. $HClO_2$. Unknown in free condition; believed to exist when chlorine trioxide, Cl_2O_3, is dissolved in water. Their solution, treated with bases, yields salts, the chlorites.

Chlorpicrin. CCl_3NO_2. Bpt. 112° C. Nitrochloroform; heavy liquid of suffocating odor, formed from many organic compounds by the simultaneous action of nitric acid and chlorine; made readily by heating picric acid with bleaching powder.

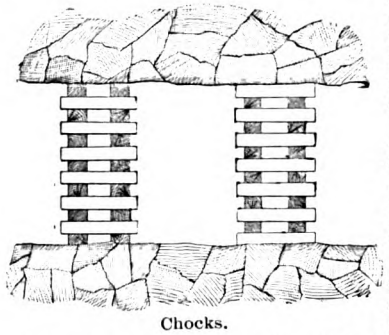
Chlorplatinic Acid. $H_2PtCl_6+6H_2O$. Crystalline compound, dibasic, made by treating platinum chloride with hydrochloric acid.

Chlorsulphuric Acid. $ClSO_3H$. Monobasic, made by treating sulphur trioxide with hydrochloric acid.

Choanocytes. Cells lining the ciliated chambers (ampullæ) of sponges, and having a collar surrounding the base of a flagellum. The collars of adjacent cells unite to form the finestrated membrane which is stretched across the ampulla nearest the prosopyle.

Choanosome. Body of a sponge, more especially that in which are the ampullæ.

Choanoflagellates. Group of *Flagellata*, including those which possess a collar of protoplasm, surrounding the base of the flagellum, so delicate as to be seen with difficulty under the microscope. It is present in the cells that line the ciliated cavities of sponges. One form (*Proterospongia*) of Choanoflagellates occurs as a colony of cells imbedded in a common gelatinous mass, into which the cells can withdraw and live an amœboid life.



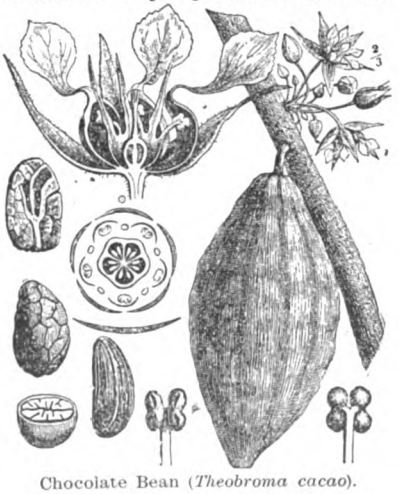
Chocks.

Choate, RUFUS, LL.D., 1799–1859. M.C. 1831-34; U. S. Senator from Mass. 1841–45. One of the foremost orators and lawyers of his time. *Works*, 1862.

Chocks. Logs laid crosswise, two by two, above each other, to support the roof of a mine.

Choco. *Sechium edule.* Climber of the Gourd family, producing a large fleshy tuber and oblong, rough fruits, cultivated in Jamaica for feeding hogs.

Chocolate Bean. Seeds of *Theobroma cacao*, a small tree of the natural family *Byttneriaceæ*, native of Tropical America, but widely distributed and grown in most tropical regions; known as Cacao Tree.



Chocolate Bean (*Theobroma cacao*).

Choczim. In s. Russia. Here the Turks were defeated by Sobieski, Nov. 11, 1673, and by the Russians April 30 and July 13, 1769.

Chodowiecki, DANIEL NIKOLAUS, 1726–1801. German engraver and painter.

Chœrilus. (1) Greek poet, ab. 450 B.C., author of a lost epic on the Persian war. (2) Versifier who lauded Alexander.

Choice. Determination of the will; selection between alternatives; fundamental condition of freedom. See VOLITION.

Choir. Singers in church, or portion of the building assigned to them, properly part of the chancel; in some Protestant communions, the organ loft.—In architecture, that part of a cathedral or other important church behind the transepts, separated by them from the nave, in which the mass was celebrated.

Choiseul et Amboise, ETIENNE FRANÇOIS, DUC DE, 1719–1785. French diplomatist, Minister 1757–70.

Choisy, JACQUES DENYS, 1799–1859. Prof. of Botany in Geneva. *Convolvulaceæ orientalis*, 1834–41.

Choke Berry. *Pyrus arbutifolia.* Shrub of the Rose family bearing small red or black fruits, native of e. N. America.

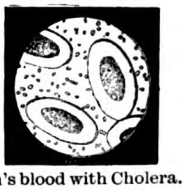
Choke Damp, AFTER DAMP, or BLACK DAMP. CO_2. Suffocating mixture of vapors found in a mine after an explosion of fire damp; chiefly carbon dioxide.

Choker. Apparatus consisting of two stout levers connected by a chain or strong rope, used by engineer troops in the fabrication of fascines, to choke them down to the required diameter and hold them till the building is completed.

Cholæmia. Condition in which bile or its elements are found in the blood. See JAUNDICE.

Cholera. Acute infectious disease, lasting ab. 60 hours; characterized by the passage of profuse watery stools resembling rice water, vomiting, cramps, and general collapse. It has prevailed as an epidemic at various times in all parts of the world, causing the death of nearly one half of those attacked. There are reasons for believing that it was known to the ancients, but the first clearly recognized epidemic occurred in India 1770. Its gravity was not appreciated until 1817, when it destroyed in Bengal nearly 5,000 soldiers in five days. From this point it spread throughout the entire Indian peninsula and Asia, reaching Europe 1830 and America 1832. Starting from the same point 1847 and following the same course, it reached America 1849, and did not entirely disappear until 1852. In 1866 it appeared among the troops stationed around New York, was scattered by them all over the country, and prevailed until the end of 1867. In 1873 it was introduced into New Orleans from the West Indies, and affected points having commercial relations with that port. It appeared in Egypt 1883 and extended over Europe, causing 250,000 deaths in three years. Great Britain was the only country which did not suffer seriously. In 1892 several steamers conveying emigrants from German and French ports appeared in New York Harbor infected with the disease, and a few cases, less than ten, developed in N. Y. City. From time to time minor epidemics have prevailed in various portions of the world, but the disease is believed to be indigenous to the delta of the River Ganges, it having occurred in Calcutta every year, with four exceptions, since 1817. All epidemics have had their starting points in that part of the world and have followed the highways of travel, progressing slowly or rapidly according to the facilities for transportation of man and merchandise; a very common route is that followed by caravans making pilgrimages to Mecca. Neither climate nor season affect its progress; it has been as violent in Russia during the winter as in milder climates in summer. There is some reason to believe that it has gained a permanent foothold in the valley of the Mississippi, as cases occur there in which there has been no possibility of its introduction from abroad. Until recently it was believed that a form of *Penicillium*, or Mould, which was found in the stools of those affected, and also upon diseased rice, was the active agent in its propagation, and it was sought to establish a connection between a failure of the Indian rice crop and the occurrence of an epidemic. It is true that failures of a staple crop like that of rice in India may be followed by pesti-

Cholera Microbes.



Pigeon's blood with Cholera.

Rabbit's blood affected.

lence, but only because insufficient and improper food predisposes the system to all forms of disease. The occurrence of sun spots was also suggested as a reason; but now it is believed that the exciting cause is a micro-organism, the *Comma bacillus*, which swarms in the stools of choleraics. Its entrance into the system by the mouth will probably establish a well-marked case of the disease: drinking water is the commonest vehicle for its transportation. It seems probable that the fresh evacuations are not very dangerous, and that they become so only after the occurrence of some unknown putrefactive changes, which are favored by heat and moisture, and but little affected by cold. It is also possible that the dried bacilli or their spores may be scattered by the wind, as some cases are on record in which infection could not have occurred in any other way. The clothing and all objects which have been in contact with a patient are also dangerous, as from them the germs may gain entrance into the food or drinking water. Although one of the most fatal of the epidemic diseases, its dissemination by practically a single agent renders it the easiest to control among rational people. The mortality among attendants upon choleraics is very much less than among those not in direct contact with the disease, and simply for the reason that those thus exposed observe proper precautions in regard to their food, drinking water, etc. The chances are largely against the contraction of the disease by a well person when the food is sound, fresh, and properly cooked, the drinking water boiled or distilled shortly before using, and all articles of diet avoided which may give rise to indigestion or diarrhœa, which favor the development of the bacillus. When the water supply of a community becomes infected the danger is great, and continues until it is purified. This was exemplified during the last epidemic in Italy, where numerous wells became polluted and formed centers of infection to such an extent that many believed them to have been intentionally poisoned. All acids are hostile to the bacilli, and one of the best precautionary measures for the exposed is the use of small doses of the mineral acids several times a day. As might be expected, the mortality is greatest among the ignorant and those forced to live under bad hygienic conditions. In every epidemic there occur many cases of diarrhœa, termed *cholerine*, which often prove fatal, or when neglected run into cholera. To prevent the spread of the disease, all affected with it and those who have been in contact with them should be isolated for three weeks, the vomit and stools disinfected, as well as the clothes, bedding, etc., the general sanitary condition of the community attended to, the use of well water discontinued when possible, public water-closets avoided, as also contact with the sick and their attendants; and, if possible, the infected district should be abandoned, until the subsidence of the epidemic, in favor of one more elevated. Treatment consists largely in the use of opium and the mineral acids. In India the most commonly employed remedy is CHLORODYNE (q.v.). It is suggested that inoculations of cultures of the *Comma bacillus* would prove effectual, and some experiments in that direction have been made, but the data are insufficient to allow of any decided statement. See COMMA BACILLUS.

Cholera Infantum. Diarrhœa of young children, occurring most often during teething and in warm weather; excited usually by improper food or exposure to cold; by far the most common cause of death among infants, especially in large cities and warm climates.

Cholera Morbus. Diarrhœa, especially that occurring in warm weather.

Cholesterin. $C_{26}H_{43}OH$. Monatomic aromatic alcohol, of which many varieties are known; present in the blood, bile, and many tissues; main constituent of gall stones, and, combined with fat acids, forms the main constituent of wool grease. Solid, melting at 145° C.

Choline. $N(CH_3)_3.OC_2H_5.OH$. Trimethyloxyethyl ammonium hydroxide; derivative of trimethyl amine; found in the brain, hops, beer, and in various fungi; a strong base; white crystalline deliquescent substance.

Cholula. Ancient city of Mexico, 55 m. e. of the capital; once populous and important; scene of a massacre by Cortes 1519. Its great pyramid still stands. Pop. ab. 6,000.

Chondrenchym. See COLLENCHYM.

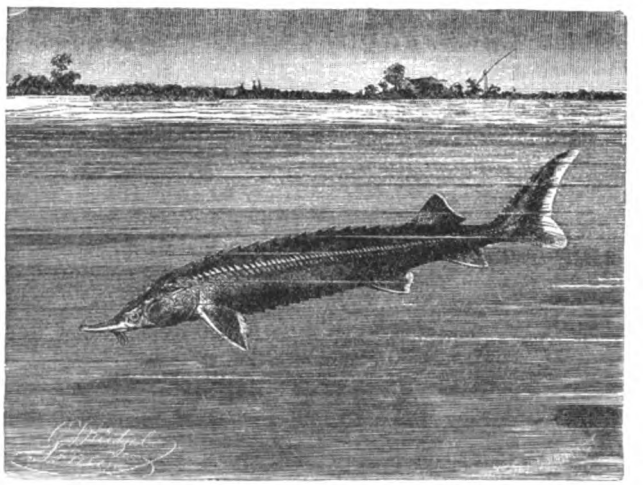
Chondrocranium. See CARTILAGINOUS CRANIUM.

Chondrodite. Granular magnesium fluo-silicate, occurring on Mt. Vesuvius, found associated with limestone in many localities.

Chondrophora. See DECAPODA and DIBRANCHIATA.

Chondropterygii. See SELACHII.

Chondrostei. Ganoids with persistent notochord, cartilaginous cranium, covered by dermal bones; with naked skin or bony plates instead of scales. Teeth are small or absent; branchiostegal rays scanty or absent; caudal fin is heterocercal, and with fulcra present. There are two groups: *Selachostomi* (Paddle-fishes), having the snout elongated and flattened for stirring



Chondrostei (*Acipenser ruthenus*).

up the bottom of fresh waters, and *Glaniostomi* (Sturgeons), of which *Acipenser*, which has spiracles, and five rows of pointed plates along the back and sides, is typical. It has no teeth and swallows other fish, etc., whole.

Chone. See SUBDERMAL CHAMBERS OF SPONGES.

Chop-Dollar. Dollar in China, Malacca, Burma, and Siam, bearing a private mark as a guarantee of genuineness. Formerly in Hong Kong and the treaty ports of China each firm stamped in this manner all coins that passed through its hands.

Chopin, FREDERIC FRANÇOIS, 1809–1849. Pianist and composer, b. near Warsaw of a French father and a Polish mother. He was musically precocious in childhood, and had a dreamy,

melancholy temperament, which is reflected in all his music. Few, if any, composers have shown so little change or development. He settled in Paris, where he speedily became the hero of the salons. The last ten years of his life were made wretched by bronchitis, consumption, and an unhappy intrigue with Mme. Dudevant, known as George Sand. As a composer his chief successes were won in the smaller forms, with marked rhythmical characteristics, as the polonaise, mazurka, bolero, tarantelle, and waltz, though perhaps there is more elegance of melody, eloquence of harmony and refinement of feeling in his preludes and studies. In classical forms he was less happy, though his two concerti still have great charm. His published works number 73.

Choragic Monument. At Athens; erected 334 B.C.; slender circular building, which once supported a bronze tripod, the prize won by a singing society, of which Lysicrates was the patron. Its beautiful Corinthian capitals are the earliest

known fully-developed form of that order. The frieze bears a celebrated line of reliefs. See ARCHITECTURE.

Choragus, or CHOREGUS. Organizer and trainer of the chorus at Athens; always a wealthy citizen, because of the large expense of feeding and lodging the singers and providing masks and costumes.

Chorale. Measured and solemn church song of Germany. It is designed for congregational use, and was one of the mighty levers used in accomplishing the Reformation. Luther did much to encourage it by his hymns. It derived much of its popularity from being frequently adapted to secular melodies. The composers in harmonizing it first placed the melody in the tenor voice. The change from that to the present style of setting with the melody in the first voice, or soprano, was introduced 1586 by Lucas Osiander. It is generally sung by the congregation in unison, the organ furnishing the harmony.

Chord. That portion of a secant line limited by the intersections with the curve.—In Music, union of sounds of different pitch.

Chorda Dorsalis. See NOTOCHORD.

Chordæ Tendineæ. Fine tendinous cords connecting the valves of the heart to the projecting muscular columns within the ventricles of the heart. They prevent the valves being driven upward by the blood pressure.

Chordata. Phylum of the Animal Kingdom, including forms which possess a notochord (at least at some early stage of their life), as in *Enteropneusta*, *Tunicata*, and *Vertebrata*. The *Enteropneusta* are termed *Hemichordata*, as forming a connecting link between the Echinoderms and Worms on the one hand and the *Chordata* on the other. The *Tunicata* are termed *Urochorda* because the notochord is present in the tail only. The *Vertebrata* have a notochord extending beneath the brain and are hence termed *Cephalochorda*, subdivided into the *Acrania* (*Amphioxus*) and the *Craniota* (Vertebrates, restricted). In a restricted use *Cephalochorda* refers only to *Amphioxus*.

Chord of Curvature. Of any point of a curve (ρ. θ) referred to polar co-ordinates; chord of the osculating circle determined by the given point and the pole of the curve. If K= the chord of curvature: ρ=the radius vector of the point and p=the distance from the pole to a tangent line through the given point; $K=\frac{2pd\rho}{dp}$ gives the length of the chord.

Chords. Horizontal members of a bridge truss. The upper one is strained in compression and the lower one in tension for simple bridges, while in continuous and draw bridges the reverse is sometimes the case. They are connected by members called collectively bracing or webbing.

Chorea (ST. VITUS' DANCE). Nervous disease in which there are more or less violent and purposeless movements of the voluntary muscles. It may attack one side of the body, or be limited to one or more muscles. It occurs most commonly in children, especially females; may follow scarlet fever or rheumatism, accompany sexual disturbances, or be inherited. In some instances a certain amount of mental trouble may accompany or follow it, but it is ordinarily uncomplicated, and rarely lasts over two months.

Chorepiscopi. Ancient bishops of country places, subordinate to those of the cities.

Chorion, or VITELLINE MEMBRANE. Thin membrane outside the zona radiata of the egg; in the mammalian ovum, the fused allantois and subzonal membrane which forms the fœtal part of the placenta; also, a delicate membrane immediately surrounding the yelk within the zona radiata when that is present.

Choripetalous. See POLYPETALOUS.

Chorisepalous. See POLYSEPALOUS.

Chorisis. Increase of the number of parts or organs of a flower by the production of two or more in the place of a single one.

Choristocarpeæ. Family of green Algæ of the order *Ectocarpaceæ*.

Chorley, HENRY FOTHERGILL, 1808–1872. English author, chiefly of musical criticisms. *Music and Manners in Germany*, 1841; *Recollections*, 1862.

Choroid. Coat of the eye next to its hard outer coat or sclerotic; made up principally of blood vessels and coloring matter, whose principal function is to furnish nourishment to the retina and lens. Its inflammation is known as Choroiditis, and is usually followed by impaired vision.

Choroidal Fissure. Embryonic cleft in the lower part of the eye, formed by the invagination of the optic stalk along its ventral side.

Chorology. Geographical distribution.

Choromania. See DANCING MANIA.

Chorus. In ancient Greece, a body of trained singers who assisted in filling out the story or in singing the lesson to be drawn from a tragedy. They numbered from 12 to 60, and were accompanied by flutes.

Chose in Action. Thing to which one has the right, as distinguished from a thing in possession or chattel; such as a bill of exchange, a bond or a claim for damages. Unless negotiable, the assignee takes it subject to equities between the debtor and the assignor, and must sue in the assignor's name. This has been modified by statute in many States.

Chosroes, or **Khosru I.** King of Persia 531–579, long at war with the Byzantines, whom his grandson, CHOSROES II., 590–628, severely chastised, conquering Mesopotamia, Syria, Egypt, and parts of Asia Minor.

Chouans. Royalists of Brittany, defeated at Le Mans Dec. 1793, and at Quiberon 1795 by La Hoche.

Chough. *Pyrrhocorax graculus.* Red-legged Crow. Widely-distributed species of the *Corvidæ* family, of the same size as the common crow, of a glossy black color shading into blue and purple, with deep orange legs and bill.

Chough.

Chree, CHARLES, b. 1860. Director of the Kew Observatory, Eng. Author of papers on *Vortex Motion; Elasticity of Solids; Stresses and Strains in a Rotating Ellipsoid; Robinson's Anemometor.*

Chrematistics. Science of wealth; portion of political economy relating to the regulation of wealth.

Chrestien, or CHRETIEN, DE TROYES, d. ab. 1192. French poet, highly esteemed in the ages of chivalry. Several of his works deal with the Arthurian legend, and were drawn upon by Tennyson for his *Idyls of the King.*

Chrestomathy. Selection of passages from Greek or other literature; similar to anthology.

Chrism. In R.C. Ch., a mixture of oil and balsam, blessed by the bishop, and used in baptism, confirmation, and ordination; or oil alone, for extreme unction. In the Greek Ch. other ingredients are added.

Christ. Anointed One, Messiah; official title of our Lord, popularly used as his surname.

Christ, WILHELM, b. 1831. Prof. at Munich from 1861, editor of Homer and Aristotle, and historian of Greek literature.

Christadelphians. Non-trinitarian Baptist sect, in England and America, founded by John Thomas, M.D., ab. 1856.

Christian IX., b. 1818. King of Denmark 1863; the house of Oldenburgh having become extinct upon the death of Frederick VII. One of his daughters married the Emperor Alexander III. of Russia; another, the Prince of Wales. His second son became King of Greece 1863.

Christian Catholics. Swiss Old Catholics.

Christian Commission. Organized in N. Y. 1861 for beneficent work among the soldiers during the Civil War.

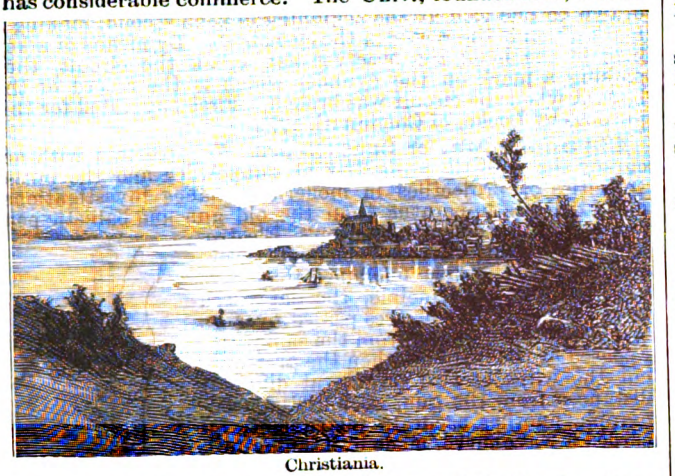
Christian Connection. See CHRISTIANS.

Christiancy, ISAAC PECKHAM, 1812–1890. Judge of Mich. Supreme Court 1857, 1865, and 1873; Chief-Justice 1872; U. S. Senator 1875–79; Minister to Peru 1879–81.

Christian Endeavor, SOCIETY OF. Organized in Me. 1881. It has spread throughout the U. S., and has largely attended annual conventions.

Christian Era. First adopted in Syria ab. 527. It aimed to begin with the birth of Christ, which (as is now believed) probably occurred 4 B.C.

Christiania. Capital of Norway, at the head of Christiania Fiord, at the base of the Egeberg. It is a seaport and has considerable commerce. The Univ., founded 1811, has ab.



Christiania.

50 profs., 1,600 students, and a library of 250,000 vols. Pop., 1891, 150,444.

Christianity. Religion founded by Jesus, and professedly accepted by the foremost nations of the globe; existing under widely differing forms of ecclesiastical organization and doctrinal conception. Repeatedly overgrown and encumbered by misconceptions in theory and corruptions in practice, it has survived as a principle of spiritual life in constant struggle with human weakness, and has contributed powerfully to such measure of civilization and progress as the human race has yet attained.

Christian Knowledge, Society for Promoting (S. P. C. K.). Founded by Ch. of England 1698, named 1701. It has done much missionary work in America, India, and elsewhere.

Christians. Name given to believers A.D. 42 at Antioch, where first they were clearly distinguished from the Jews. Acts xi. 26.

Christians, or Christian Connection. Denomination beginning in Va. and N. C. 1792, in New England and Ky. 1800–2, with the Bible for its only creed, and practicing immersion; affiliated chiefly with the Free Baptists. It had, in 1890, 1,424 churches and 103,722 full members.

Christian Socialism. Doctrine that Christianity and the current individualism are irreconcilably opposed, and that a more perfect application of Christian principles would modify society in the direction of Socialism.

Christians of St. Thomas. Ancient sect in s. w. India claiming spiritual descent from the Apostle Thomas, but probably of Nestorian origin. It now has ab. 97 churches, many having conformed to Rome.

Christina, Queen of Spain. See Maria Christina.

Christina, 1626–1689. Queen of Sweden 1632–54, daughter of Gustavus Adolphus; noted for ability and eccentricity. She abdicated in favor of her cousin, Charles Gustavus, and spent her later years in Rome, where she cultivated learning, founding a literary society, called the "Arcadians."

Christison, Sir Robert, M.D., LL.D., D.C.L., 1797–1882.

Robert Christison.

Prof. Univ. Edinburgh 1822–77; Baronet 1871. *Poisons*, 1829; *The Kidneys*, 1839; *Dispensatory*, 1842.

Christlieb, Theodor, D.D., Ph.D., 1833–1889. German pastor in London 1858–65; prof. at Bonn from 1868. *Scotus Erigena*, 1860; *Modern Doubt*, 1868, tr. 1874; *Prot. Missions*, 1879, tr. 1880.

Christmas. Festival commemorating Christ's birth, observed everywhere on Dec. 25. Till ab. 376 it was kept in the East on Jan. 6.

Christology. Doctrine of the Person of Christ; an important department of theology, diligently cultivated and studied since ab. 325.

Christophe, Henri, 1767–1820. Insurgent in Haiti 1790, general 1806, Pres. 1807, King 1811.

Christopher, St. Alleged Syrian martyr ab. 250; in German legend a giant who, bearing a child across a ferry, found that he had carried the Saviour, and therefore took the name Christ-bearer. His day in R. C. Ch. is July 25, in the Eastern May 9.

Christophorus. Pope 903–4.

Christopoulos, Athanasios, 1772–1847. Greek dramatist.

Christ's Hospital. In Newgate Street, London, known as The Blue Coat School; founded by Edward VI. 1553. A mathematical school was added 1672 by Charles II. It has an annual income of over £60,000; admits boys between seven and ten, but keeps none after fifteen; has room for 800, and in the preparatory school on the same foundation at Hertford, founded 1683, for 440 more. Girls also are admitted at the latter. The ancient dress is still retained. A new plan of removal 1891 provided for two day-schools, accommodating 600 boys and 400 girls.

Christy, Edwin P., 1815–1862. Organizer of Christy's Minstrels at Buffalo, N. Y., 1842, and their manager till 1854.

Chromates. Salts of chromic acid, $HCrO_4$; made by replacing the hydrogen with a metal.

Chromatic Aberration. In consequence of the different refrangibility of rays of light of different colors, a single lens will not bring all rays to a common focus; the focus of the violet rays is nearer the lens than that of the red. With such a lens the image of a star is a circle of light differing in color from center to circumference.

Chromatic Mitom. See Mitom.

Chromatic Polarization. Phenomena of colors produced by thin plates of mica or selenite when placed between the analyzer and polarizer of a polariscope.

Chromatin. Substance found in the nucleolus of cells, which stains with ordinary coloring reagents.

Chromatophores. Protoplasmic granules of vegetable cells which may contain chlorophyll or other coloring matters. —Pigment cells in the skin of Cuttle Fishes, the Chamæleon, and other animals; they have the power of changing their shape and so modifying the color of the skin as a whole.

Chromatopsia. Condition in which objects appear colored.

Chrome Alum. Potassium chromium sulphate. $CrK(SO_4)_2.12H_2O$. Large, violet octahedra, made by treating potassium dichromate with sulphuric acid, soluble in water, used in dyeing and tanning.

Chrome Iron Ore. See Chromite.

Chrome Red. Basic lead chromate made by treating chrome yellow with a quantity of sodium hydroxide insufficient to dissolve it. Used as a pigment.

Chrome Yellow. Lead Chromate (q.v.).

Chromic Acid. H_2CrO_4. Unknown in free condition; believed to be formed when chromium trioxide is dissolved in water.

Chromic Hydroxide. $Cr(OH)_3+2H_2O$. Light blue precipitate, formed by adding ammonium hydroxide to a chromic salt. When heated it is converted into CrO.OH, and finally into Cr_2O_3.

Chromic Oxide, or Sesquioxide. Cr_2O_3. Green powder, made by heating chromic hydroxide; used in coloring glass and painting porcelain.

Chromic Sulphate. $Cr_2(SO_4)_3$. When the hydroxide is dissolved in sulphuric acid, purple crystals of $Cr_2(SO_4)_3+15H_2O$ are deposited.

Chromidrosis. Condition in which the sweat is colored.

Chromite, or Chromic Iron. $FeCr_2O_4$. Mineral resembling magnetic iron but containing chromium sesquioxide in place of ferric oxide; used in the manufacture of chrome pigments. In the U. S. mines of chromite have been worked in Md. and in Cal. Russia, Turkey, and Asia Minor contain valuable deposits.

Chromium. Cr. At. wt. 51.69; sp. gr. 6.8. Discovered

by Vauquelin 1797. It occurs principally as chromite, and to some extent as crocoisite. When heated in the air it forms chromic oxide; it dissolves easily in sulphuric and hydrochloric acids. It forms three classes of compounds: *chromous*, in which it is bivalent; *chromic*, in which it is trivalent; and those derived from chromic acid, in which it is sexivalent. Its compounds are colored.

Chromium, METALLURGY OF. Principal ore is chromite, compound of chromic oxide and oxide of iron, widely distributed, especially in serpentine rocks. The pure metal is not well-known, as it is very difficult to prepare pure, and the alloy of iron and chromium has been its only industrial application. Wöhler first isolated it, as a powder, by reducing its oxide by zinc. Deville reduced the oxide by carbon at a very high temperature, in a lime crucible. Bunsen electrolyzed a concentrated solution of chromium chloride, and obtained the pure metal. Placet electrolyzes a solution of chrome alum, potassium sulphate, and sulphuric acid. This last process has arisen in France (1892), and large ingots of chemically pure chromium are being put on the market at a moderate price. The alloy of iron and chromium used for making chrome steel is made by intensely heating in a crucible a mixture of carbon, iron oxide, and potassium bichromate. When this alloy is added to steel it produces an intensely hard metal, suitable for chisels, punches, dies, etc. Pure chromium is white, sp. gr. 6.8, very hard, less fusible than platinum, and resists attack by the strong acids except hydrochloric. Metallic chromium is also electroplated upon engraved steel plates, to give them a harder surface. See STEEL.

Chromium Trioxide, or ANHYDRIDE. CrO_3. Red crystals obtained by treating a chromate or dichromate in concentrated solution with sulphuric acid, and evaporating. It is an excellent oxidizing agent, and used extensively for that purpose in the laboratory. Dissolved in water it yields a solution which if neutralized gives the chromates.

Chromogenic Bacteria. Those that produce a pigment during growth, such as the red pigment of *Bacterium prodigiosum*, whose appearance on damp bread was once considered a miracle, the "bleeding host."

Chromo Lithograph. See LITHOGRAPHY.

Chromoplastids, or CHROMOLEUCITES. Protoplasmic grains occurring in vegetable cells containing coloring matters other than chlorophyll.

Chromosphere. Gaseous envelope or atmosphere of the sun; of uncertain extent, but rising many thousands of miles above the visible surface.

Chromule. Coloring matters of plants, other than chlorophyll.

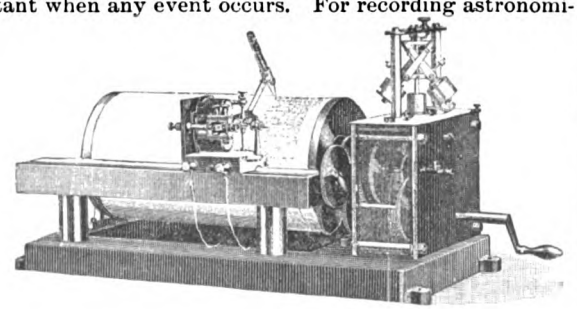
Chrondrin. Substance resembling gelatin, obtained by boiling permanent cartilages with water, evaporating to a jelly and removing the fat with ether. It jellies with water, is soluble in boiling water, and insoluble in alcohol and ether. Acids precipitate it from water solution, soluble in excess. Alum precipitates it, soluble in excess, differing in this from gelatin. It contains carbon 49.3, hydrogen 6.6, nitrogen 14.4, sulphur 0.5 per cent.

Chronicles. Thirteenth and fourteenth O. T. books, giving history of the tribe and kingdom of Judah, especially of the temple worship, and numerous genealogies, down to the Captivity, 588 B.C.

Chroniques de France, GRANDES. French records, first made 1274, by Primat, a monk of St. Denis.

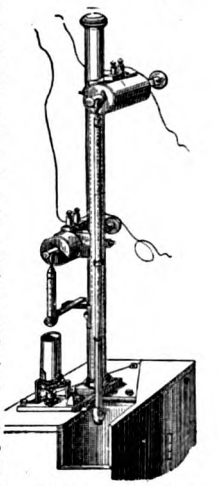
Chronizoöspore. Resting-spores of the Algæ genus *Hydrodictyon*.

Chronograph. Instrument for recording graphically the instant when any event occurs. For recording astronomical observations it usually consists of a cylinder ab. 16 in. long by 6 in diameter, revolving by clock work once per minute. A pen touches the cylinder, having a slow movement in the direction of the axis; it is thus made to trace a helix on the cylinder. By an electric connection with the clock pendulum it is drawn to one side at the beginning of each second, making a mark which is the record of the clock beat. By means of a key held in the hand the observer can break the circuit, thus making a mark on the cylinder which is the record of the instant when the circuit was broken. First suggested for this purpose by Locke, of Cincinnati, 1850.



Chronograph.

Chronograph, or CHRONOSCOPE. To ascertain with accuracy the ballistic properties of gunpowder and the initial velocities of projectiles in modern ordnance investigations, more delicate apparatus than the old gun and ballistic pendulums are required. Benton's Electro-ballistic and his Thread Velocimeter were the first of the new machines that gave good results. In principle, the data used were the differences of arcs passed over by two pendulums, swung from the same axis, released at the instants when the projectile cut the wires of two targets at different distances from the gun. Schultz's Chronograph, another accurate instrument, recorded a wave curve, made by a tuning-fork of known pitch, on a blackened cylinder, and an electric spark left a record of the time of passage of each target; the number of vibrations could then be counted, and hence the interval of time computed. The best device, however, is the Le Boulengè Chronoscope, in which a falling rod, released at the instant of rupture of the first target, is marked by a cut, at the instant of rupture of the second target. The laws of falling bodies permit the time of fall to be easily computed. The adjustments and corrections to be applied for extreme accuracy are by no means difficult, and the last apparatus is now of most general use.



Le Boulenge's Chronoscope.

Chronology. Science which determines duration of periods and order and succession of events. The apparent motions of the heavenly bodies suggested convenient measures of time very early in the world's history, and striking events to which all others were referred occurred in every nation's life. The Egyptians adopted a solar year of 365 days, the Greeks, Jews and others followed a year partly solar and partly lunar, while that of the Mohammedans is entirely lunar, containing 12 moons. For an era from which to date the Jews boldly went to the Creation; the Romans to the founding of their city (ab. 753 B.C.); the Greeks chose the first Olympian game (776 B.C.) and reckoned by Olympiads of 4 years; the Mohammedans began with the Prophet's flight from Mecca, called the Hegira, A.D. 622, and all Christian nations since the 6th century have dated from the birth of Christ. See CALENDAR.

Chronometer. Instrument for the accurate measurement of time. It differs from the watch chiefly in the accuracy of its construction, and in having the balance accurately compensated for changes of temperature. It is of great use in navigation, and in astronomical and physical observations.

Chroococcaceæ. Order of *Cyanophyceæ*, the blue-green Algæ, comprising the forms of strictly unicellular habit. Simplest of all chlorophyll-bearing plants.

Chrysalis. Pupa case of a Lepidopteran insect, often made of fine-spun fibers like the cocoon of the Silk Worm. Also any inactive pupa.

Chrysamine G. $C_{26}H_{16}N_4O_6Na_2$. Sodium salt of the compound, formed by the action of diazobenzidine upon salicylic acid; yellow compound, soluble with difficulty in water. It dyes cotton a fast yellow without a mordant. Chrysamine R. is similarly produced from orthotolidine.

Chrysander, FRIEDRICH, b. 1826. Ed. *Allegemeine Musikalische Zeitung* from 1868 to 1871; associate ed. *Vierteljahrschrift fur Musikwissenschaft*; biographer of Handel and ed. of his works.

Chrysaniline. See PHOSPHINE.

Chrysanthemum. Genus of showy-flowered plants of the Composite family, natives of the n. hemisphere. The cultivated kinds are mainly derived from Asiatic species.

Chryselephantine Statues. Of colossal size, made in Greece for temple shrines, and built up over an inner framework of timbers. The exterior of the statue was of ivory for the flesh parts and of gold for all drapery and other details. The statues of Athena and of Zeus, by Phidias, made for the Parthenon and the temple of Zeus at Olympia, were especially famed. None of these statues are known to have survived the 5th century.

Chrysene. $C_{18}H_{12}$. Mpt. 250° C. Aromatic hydrocarbon, obtained from coal tar, containing a benzene nucleus and a naphthalene nucleus. It crystallizes in white plates which show an intense violet fluorescence; is soluble in hot benzene and glacial acetic acid, and yields a ketone on oxidation.

Chrysippus, ab. 280–207 B.C. Pupil of Cleanthes, and his successor in the Stoic school of Athens; famous as a dialectician. His numerous writings are lost.

Chrysoberyl. $BeAl_2O_4$. Yellowish green, frequently transparent mineral, nearly as hard as corundum, and esteemed as a gem. An emerald-green variety found in the Ural Mts. is known as Alexandrite, a glucinum aluminate. It is found in the U. S., but not often in handsome specimens.

Chrysochloridæ (GOLDEN MOLES). Family of *Insectivora*, including African Moles with iridescent fur. The second and third digits of the manus are much more developed than the rest, and are armed with immense claws. The teeth also differ from those of the true Moles.

Chrysocolla. $CuSiO_3+2aq$. Soft, bluish-green, hydrous copper silicate, of low specific gravity; apparently a product of alteration from other copper ores; a valuable ore when abundant. This name was formerly given to borax.

Chrysoidine. $C_{12}H_{12}N_4.HCl$. Mpt. 117° C. Diamidoazobenzene hydrochlorate; red brown crystals, prepared by the action of diazobenzene salts upon metaphenylene diamine; orange dye-stuff, crystallizing in needles.

Chrysoin. $C_{12}H_9SN_2O_5Na$. Dioxyazobenzene sulphonic acid. Sodium salt of the compound, prepared by the action of diazosulphonilic acid on resorcin; brown powder, used as a yellow dye; called also Resorcin Yellow, Tropæolin O.

Chrysoline. Sodium salt of the product obtained by treating resorcin with phthalic anhydride and benzyl chloride in the presence of sulphuric acid; used for dyeing silk yellow.

Chrysolite. $(Mg.Fe.)_2SiO_4$. (1) Olive-green magnesium and iron silicate, common in basalt; when clear and transparent it is valued as a gem and known as peridote. Also called olivine. (2) Some zircons, tourmalines, and other minerals.

Chrysologus, PETER, 406–450. Bp. of Ravenna 433; so called from his eloquence. 100 of his sermons survive.

Chrysoloras, MANUEL, ab. 1355–1415. Byzantine scholar, teacher of Greek in Italy from 1396. He tr. Plato's *Republic* into Latin.

Chrysoprase. Bright apple-green chalcedony. That of antiquity was possibly beryl.

Chrysostom, JOHN, ST., 347–407. Patriarch of Constantinople 398; greatest preacher of his time. His earnest eloquence offended the court, and he was banished to Armenia 404.

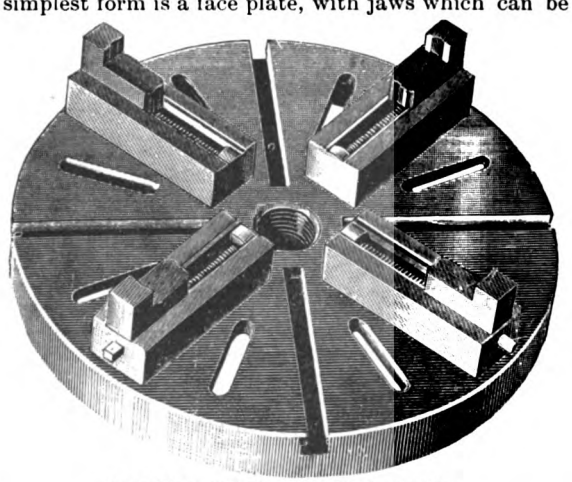
Chrysotile. $Mg_3Si_2O_7+2aq$. Fibrous variety of serpentine; amianthus; known in commerce as asbestus, and obtained in large quantities in Canada.

Chthonascidiæ. See TETHYOIDEA.

Chuba. Game of skill played with 60 small beads upon a board having 44 holes or pockets in 4 parallel rows. It is a direct modification of an ancient game widely diffused throughout Africa and the Mohammedan East, and best known by its Arabic name of MANCALA (q.v.).

Chubb, THOMAS, 1679–1747. English deist.

Chuck. Attachment to a turning lathe for holding work. The simplest form is a face plate, with jaws which can be adjusted in radial slots by screws; when these jaws are geared together so that to move one is to move them all, the chuck is self-centering; of this there are two types, the scroll and the geared. When the chuck is made more complex, so that double motions may be given to work fastened to it or by it, it may be used to turn ovals and ellipses or figures of great complexity. The self-centering type is much used to hold small round work, and for drills.



Face Plate with Chuck Jaws in Position.

Chuki. Malayan game played with 60 white and 60 black stones, placed at the intersection of the lines upon a square board of 100 squares, and taken off by the two opposing players according to the throws with three dice in a cup placed in the middle of the board.

Chung-King. City of s. China, on the Yang-tse-Kiang, ab. 1,700 m. from the sea; founded ab. 1380. Pop. ab. 250,000.

Chunkee. Aboriginal American game, found widely diffused among the N. American tribes. A small circular disc was rolled rapidly along a prepared surface, and prepared wooden implements, similar to spears, were launched at the disc when it was in motion, or just when it stopped. Polished discoidal stones were generally used.

Church. Word derived from the Greek *Kuriakon*, the Lord's, and bearing various meanings.—Society founded by Christ, and historically traceable from the Apostles; ideal union of all believers; or any section of either of these, denominationally, nationally, or locally; also, a building consecrated to divine worship. In pre-Christian times, the Jewish theocracy. Beyond these, the term is but loosely applicable, if at all.

Church, ALBERT E., LL.D., 1807–1878. Prof. of Mathematics at West Point from 1833. *Calculus*, 1843–51; *Analytical Geometry*, 1851, and *Trigonometry*, 1857; *Descriptive Geometry*, 1865.

Church, ALFRED JOHN, b. 1829. Prof. Univ. Col., London, 1880–89; author of many tales drawn from classical sources, as *Stories from Homer* and *from Virgil*, 1877–78.

Church, FREDERIC EDWIN, b. 1826. American painter. Among his chief works are: *Heart of the Andes*, *Parthenon*, and *Great Fall, Niagara*, the latter in the Corcoran Gallery, Washington.

Church, FREDERICK STUART, b. 1842. American painter of imaginative subjects. *Viking's Daughter; Knowledge is Power.*

Church, IRVING PORTER, C.E., b. 1851. Prof. in Cornell Univ. 1892. *Mechanics of Engineering*, 1890.

Church, SIR RICHARD, 1784–1873. Irish officer in Greek service from the war of independence 1824.

Church, RICHARD WILLIAM, D.C.L., 1815–1890. Dean of St. Paul's, London, 1871. *St. Anselm*, 1871; *Dante*, 1878; *Spenser*, 1879; *Bacon*, 1884; *Oxford Movement*, 1891.

Church, SANFORD ELIAS, LL.D., 1815–1880. Lieut.-Gov. of N. Y. 1850–54; Comptroller 1857; Chief Judge Court of Appeals, 1870.

Church and State. Union of the two with the Jews, and in Christendom from Constantine's reign; still existing, in more or less modified forms, throughout Europe.

Church Congress. Annual assemblage of Anglican clergy and laity since 1861 for free discussion; in P.E.Ch. of the U. S. since 1875.

Church History. Important department of theological and general study, always cultivated, though seldom impartially. It deals with the outward and inward fortunes of organized Christianity, the development of doctrine, the rise of sects and heresies, the varied relations between spiritual and temporal powers. Long under persecution, the Ch. became dominant in the Roman Empire ab. 320. Then came the œcumenical councils, papal pretensions, the split between East and West, the gradual conversion of the north, and the darkness of the Middle Ages. The crusades against the Moslems 1095–1272 widened the views of Christendom; those against the Albigenses stimulated the persecuting spirit, which raged for four centuries. The Protestant Reformation broke the previous uniformity and changed the face of Europe; violently suppressed in the south, it prospered in the north and west, and gave rise to many contending sects. Liberty of religious thought and action is a precious plant of recent growth; but Christian unity appears a millennial dream.

Churchill, CHARLES, 1731–1764. English poet and satirist. *The Rosciad*, 1761.

Churchill, LORD RANDOLPH HENRY SPENCER, 1849–1895. M. P. from 1874; Sec. for India 1885; leader of the House of Commons and Chancellor of the Exchequer 1886. Noted for boldness, independence, and eccentricity.

Churchill River. In Canada, rising in the Great Plains and flowing e. to Hudson's Bay. Length ab. 800 m.

Churching of Women. Public thanksgiving after childbirth; rite retained in R. C., Greek, and Anglican churches.

Church of God. Sect founded 1830 by John Winebrenner at Harrisburg, Pa., practicing immersion and feet-washing. It had in 1890 479 congregations and 22,511 members, chiefly in Pa. and Ohio.

Church of Scotland. See SCOTLAND, CHURCH OF.

Church Rates. Originally tithes: tax in England for repair of church buildings and property; resented and sometimes resisted by dissenters.

Church, ROMAN. Diocese of Rome, embodied in the Pope, assisted by the Cardinals, and claiming divine right to teach and govern the Universal Church.

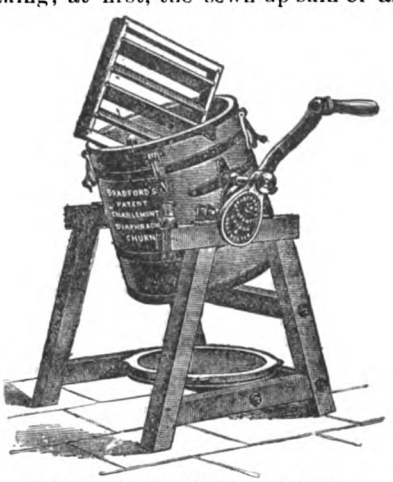
Church, STATES OF THE. Middle Italy, from ab. 755 a temporal sovereignty of the Popes; greatly reduced 1860, and absorbed 1870, when Rome, the last fragment, was occupied by King Victor Emanuel.

Churchwardens. Two lay officers in each English parish; in P. E. Ch., members of the vestry.

Churchyard, THOMAS, 1520–1604. English miscellaneous writer.

Church Year. Round of Christian festivals, fasts and seasons, the principal feasts being Christmas, Easter and Whitsunday; the chief fasts Ash Wednesday and Good Friday. It begins with Advent Sunday.

Churn. Machine in which cream is agitated in the process of butter-making; at first, the sewn-up skin of an animal in



The Charlemont Diaphragm Churn.

which the milk or cream was agitated by shaking. That once exclusively, and still extensively, used in many places was the dash churn; an upright wooden or stone vessel with a vertical wooden plunger or dash, in which the agitation was produced by moving the dash up and down. The best churns of the present day are those in which the concussion of the particles of cream is brought about by the revolution or vibration of the vessel without the aid of paddles or stirrers, and consist of simple barrels or boxes properly mounted and propelled by hand or power.

Churubusco. Near city of Mexico; scene of a victory of Gen. Scott over the troops of Santa Anna, Aug. 20, 1847.

Chute, or SHOOT. In mining, an inclined open passage down which coal or ore slides to a loading-place; also an elongated body of ore that has a downward direction.

Chutnee, or CHUTNEY. Condiment used universally in India; is composed of green mangoes, raisins, mustard-seed, salt, green ginger, and garlic, onions, sugar and white wine vinegar.

Chylaqueous Fluid. Water containing digested food, circulating in the chymiferous tubes of Actinia, Worms, etc.

Chyle. Milky white fluid, consisting principally of the emulsified fat of the food, absorbed from the intestines by the lacteals and delivered by them directly into the blood.

Chylific Ventricle. Digestive stomach of insects.

Chyluria. Presence of fat in the urine, giving it a milky appearance; due to the presence in the blood of the embryoes of the parasite *Filaria sanguinis hominis.*

Chyme. Gruelly mass into which the food is converted in the stomach by the action of the gastric juice.

Chymiferous Tubes. Those that radiate from the gastric cavity of Jelly fish and serve the purpose of blood vessels in the absence of a true circulation.

Chytræus, or KOCHHAFE, DAVID, 1530–1600. Lutheran theologian, prof. at Rostock.

Chytridiaceæ. Order of minute parasitic Fungi of the sub-class *Phycomycetes*; of aquatic habit, occurring on various plants.

Cialdini, ENRICO, 1811–1892. Italian general, prominent in the wars of liberation; Senator 1864; Ambassador to Paris, 1876–81.

Cibaria. See INSTRUMENTA CIBARIA.

Cibber, COLLEY, 1671–1757. English actor and dramatist; poet-laureate 1730. *Apology,* 1740.—His son THEOPHILUS, 1703–1758, also wrote plays.

Ciborium, or PYX. Vessel used to contain the host, or consecrated wafer, in R. C. Ch.; also, the bowl-shaped canopy surmounting an altar.

Cibrario, LUIGI, 1802–1870. Piedmontese statesman; historian of Savoy 1840, and Turin 1847.

Cicada, CICADARIA. See HOMOPTERA.

Cicatricula. Small white spot on one side of the yolk which tends to keep uppermost. It is coextensive with the blastoderm of the chick at the beginning of its development.

Cicatrix. Scar; in botany, leaf-scar.

Cicatrization. Process of healing by means of a cicatrix or scar, which consists of a form of fibrous tissue of low vitality and with a tendency to contract. Scars frequently are the locations of cancers and other morbid growths.

Cicero, M. TULLIUS, 106–43, B.C. Roman author and statesman; b. at Arpinum, and educated at Rome, Athens and Rhodes. Though not of noble birth, he rose rapidly by his oratory, and was made consul for the year 63, during which he crushed the conspiracy of Cataline and had some of the conspirators executed. Politics were unsettled and Clodius in 58 procured his banishment. On his return he was Gov. of Cilicia 51–50, took sides with Pompey; devoted much to literary labors; reentered the political arena to oppose Antony, against whom he delivered his celebrated Philippic; and on the formation of the second triumvirate was proscribed and assassinated. He was the greatest of Latin prose writers and the most powerful of Roman orators. His writings cover a wide range of subjects. Some 60 orations exist in whole or in part, and a series of works upon rhetoric and the philosophy of taste. Politics are represented in his *Republic* and books *De Legibus*, Moral Philosophy by *De Officiis*, *Cato Major*, and *Laelius*, with minor treatises. The *De Finibus* and the *Tusculan Disputations* are the most important of his metaphysical works; and the *De Natura Deorum* and the *De Divinatione* the principal ones in theology. He has exerted more influence upon Latin thought and literature than any other Roman writer; his character was far above the standard of his time.

Cichoriaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising numerous genera and species of wide geographic distribution; commonly known as the Chicory family.

Cicognara, LEOPOLDO, COUNT DE, 1767–1834. Italian writer on art. *History of Sculpture*, 3 vols., 1813–18.

Ciconiæ. Storks. See HERODII.

Cid. RODRIGO, or RUY, DIAZ DE BIVAR, ab. 1040–1099. Most famous of Spanish knights. He served Sancho II. of Castile; was banished by Alfonso II. 1081; aided Moor or Christian as suited him; was called Cid (lord) and Campeador (champion); took Valencia 1094, and held it. The *Poem of the Cid*, an epic of ab. 1160, is the earliest important specimen of Spanish verse. It was freely rendered, with additions from a later prose *Chronicle*, by Southey, 1808, and more literally by J. Ormsby, 1879.

Cidaridea. Sea Urchins; with central mouth, teeth and masticatory apparatus, and a sub-central anus in the apical space. *Arbacia* is an example of the family *Echinidæ.*

Cider. Alcoholic beverage made from the expressed juice of the apple and occasionally of other fruits. Usually only the inferior fruit is used, and it is only when the crop is very abun-

dant that the making of cider becomes an important means of disposing of surplus fruit. When fermented it contains from 5 to 10 per cent of alcohol.

Cienfuegos. Port of s. Cuba. Pop. ab. 20,000.

Cienfuegos, NICASIO ALVAREZ DE, 1764–1809. Spanish poet.

Cieza de Leon, PEDRO DE, 1518–1560. Spaniard, long serving in America. *Chronicle of Peru*, part i. 1553, ii. 1873, iii. 1877.

Cigar. See TOBACCO.

Cignani, CARLO, COUNT, 1628–1719. Italian painter.

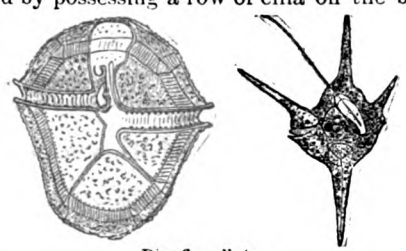
Cigoli, LUDOVICO CARDI DA, 1559–1613. Italian painter and architect.

Cilia. Fine hair-like appendages, to many kinds of vegetable spores and to minute plants and animals, by which cells set up currents of air or water and many minute animals propel themselves; also, any hair-like process, whether automatically motile or not, as the eyelashes.

Ciliata. Those *Infusoria* which possess cilia but no flagella. They usually have a nucleus and a paranucleus, and exhibit cell copulation or conjugation. Some, like *Paramœcium*, are visible to the naked eye. They are divided into the *Holotricha*, *Heterotricha*, *Hypotricha*, and *Peritricha*.

Cilicia. S. e. district of Asia Minor. It formed a satrapy under the Persian empire, was governed by Seleucidæ after the death of Alexander, and became a Roman province 66 B.C. Aratus, Chrysippus and St. Paul were born in it.

Cilioflagellata, or DINOFLAGELLATA. Group of *Infusoria*, characterized by possessing a row of cilia on the body in addition to a flagellum. *Ceratrium tripos* is triangular, with the corners produced into curved horns; the body is incased in a shell in a groove of which one of the cilia plays. There are two orders, *Adinida* and *Dinifera*.



Dinoflagellata.

Ciliograda. See CTENOPHORA.

Ciliolum. Minute cilium.

Cimabue, GIOVANNI, 1240–ab.1302. Florentine painter, who represented the dawning independence from Byzantine style, which he still followed rather closely. Mosaic in the apse of the Pisa Cathedral; famous *Madonnas* in Church of Maria Novella and the Academy, Florence. Frescoes, much damaged, in Church of St. Francesco, Assisi.

Cima da Conegliano, 1460–1517. Venetian painter of altar pieces and Madonnas, of style archaic and severe, but firm. His *Doubt of St. Thomas* is in the National Gallery in London.

Cimarosa, DOMENICO, 1749–1801. Italian musician, composer of 76 operas, of which one, *Il Matrimonio Segreto*, is still admired. His labors were chiefly given to Naples, Rome, Florence, and Vienna.

Cimarron River. Right hand branch of the Arkansas, in I. T. and Ark. Drainage area 16,632 sq. m.

Cimborio. In Spanish architecture, tower erected at the juncture of the nave and transepts, with windows opening into the body of the church.

Cimbri. Celtic or Teutonic tribe, who migrated s. 113 B.C., defeated several Roman armies, entered Spain, then Gaul, and were destroyed by Marius in a battle near Verona 101 B.C.

Cimicifuga Racemosa. Black snakeroot, black cohosh, American ranunculaceous plants, the rhizome and rootlets of which are used in rheumatism and various uterine disorders.

Cimmerians. (1) Mythical people living in mists and darkness in the far West. (2) Tribe driven from their abodes on the Sea of Azov into Asia Minor by Scythians. They took Sardis 635 B.C. and were expelled by Alyattes of Lydia ab. 600.

Cimolite. $Al_4Si_9O_{24}+6aq$. Light, clay-like, hydrous aluminium silicate, so called from the island of Argentina (Cimolia), where the mineral is found.

Cimon, ab. 502–449 B.C. Athenian statesman and general, son of Miltiades. He commanded the allied Greek forces in the Persian war, gained both a naval and a land victory at mouth of Eurymedon 466, and was without a rival at Athens until overshadowed by Pericles; was ostracized 461, and recalled 456.

Cinch, or HIGH FIVE. Card game played with a full deck, the cards ranking as in whist. Nine cards are dealt to each player, three at a time and no trump is turned. Bids are now made by each player in his turn for the privilege of naming trump: now each player discards three cards or more, if more than three the dealer gives the player a sufficient number to make six cards. The discard is placed face up, and should it happen that there are not sufficient cards left in the pack to complete the hands, the player picks his required number from the discard, but is not allowed to take a point. If cards remain in the pack they are placed face down. This is called the "widow." The highest bidder then names his trump and leads, but is not obliged to lead trump. "High," "Low," "Jack" and "Game" each count one, being respectively the highest trump out, the lowest trump out, the knave of trumps and the ten of trumps, "Pedro" the five of trumps counts 5 and "Cinch" the five of the same color as the trump 5. The game is usually 52 points. If the bidder does not make as many points as he bid, he falls back the number of points he bid and is not allowed anything for the points he did make. "High" and "Low" always count to the player to whom they were dealt, but all the other points can be taken away from him. After the hand is played, all points found in the discard go to the player that made trump, provided he did not discard them himself. There are many variations made in this game, in different localities. Very often the dealer is given the privilege to go through the "widow" and take any card he wishes. Known also as Double Pedro.

Cinchona. Genus of trees of the natural family *Rubiaceæ*, natives of the Andes; now cultivated extensively in the E. and W. Indies for their bark, which yields various alkaloids (quinine, cinchonine, cinchinine, and cinchonidine), employed in medicine as febrifuges.

Cinchona lancifolia.

Cinchonidine. $C_{19}H_{22}N_2O$. Mpt. 207°.2 C. Base obtained from cinchona bark; soluble in alcohol, from which it crystallizes in large prisms.

Cinchonine. $C_{19}H_{21}N_2OH$. Mpt. 250°C. Base derived from quinine by replacing hydrogen by the group $.OCH_3$, quinoline derivative. It is a febrifuge, but one-half the strength of quinine; it is much cheaper but much less used than the latter. Soluble in alcohol, crystallizing in white prisms.

Cincindelidæ (TIGER-BEETLES). *Coleoptera*, with five jointed tarsus, bodies of graceful build, long slender legs, and mandibles with three teeth; mostly running or ground beetles.

Cicindela hybrida.

The larvæ live in underground passages, at the openings of which they lie in wait for prey, and are anchored by two horny hooks on the back of the eighth segment.

Cincinnati. City of Hamilton co., Ohio, largest of the

State and of the Ohio Valley; on n. bank of the Ohio near s. w. corner of the State. It is built mainly on the bottom land, which consists of a series of terraces rising from the river; its suburbs extend up the high bluffs beyond. It is one of the most important railroad centers in the country, having 18 lines radiating to all points. More than one-half of its streets are paved, mainly with cobblestone and macadam. Water is supplied from the Ohio R. by pumping. The denser portion of the city is sewered. Its manufactures are very extensive and varied, employing more than $90,000,000 of capital; prominent among them are iron and steel, clothing, furniture and meat-packing. C. was settled in 1788, as Losantiville, and chartered 1819; enlarged 1870, to include 17 sq. m. Scene of great riots in 1884, which were with difficulty suppressed. The failure of the laws against criminals, and the frequency with which they escaped punishment through legal technicalities, aroused the citizens to hold a mass meeting. Mobs burned the court-house and jail. Pop., 1890, 296,908, with ab. 100,000 more in the suburbs.

Cincinnati, Order of. Instituted in the U. S. 1783 by army officers, and maintained by their descendants. Washington was its pres. 1787–99. It has branches in several States.

Cincinnati (O.), University of. Founded by will of Charles McMicken (d. 1858), who left to the city property worth over $1,000,000; other bequests have since been received, and a small tax is levied. It was organized 1874; admits both sexes; offers 8 courses of study, including medical and dental; had, in 1894 12 professors, 4 instructors, and 271 students in the academic departments, 603 in 3 medical schools, 158 in dental surgery and 63 in pharmacy.

Cincinnatus, Lucius Quintius, b. ab. 519 B.C. Roman dictator 458 B.C., when he saved the consul and army by defeating the Æquians, and again 439; semi-legendary model of republican simplicity and patriotism.

Cincinnus. Modification of the cymose flower cluster.

Cinclis. Small opening in the body wall of a sea-anemone.

Cinder Ballast. Broken furnace slag, used around and beneath the ties of a railroad track to insure good drainage and make a firm roadbed.

Cineas, d. ab. 270 B. C. Thessalian diplomatist, sent by Pyrrhus to Rome 280 B.C.

Cinemograph. Register of wind velocity, as distinguished from wind direction.

Cinerary Urns. Anciently used to hold the ashes of the dead.

Cingulum. Clitellus of Earthworms.

Cinna, C. Helvius, d. 44 B.C. Latin poet, author of an epic, *Smyrna*, now lost.

Cinna, Lucius Cornelius, d. 84 B.C. Roman consul 87 B.C. and later; partisan of Marius and at war with Sulla; father-in-law of Julius Cæsar.

Cinnabar. HgS or Hg_3S_3. Bright red, heavy mineral, containing when pure 86 per cent mercury and 14 per cent sulphur, the same composition as that of manufactured vermilion; the only mineral from which the mercury of commerce is obtained. The most celebrated deposits are those of Almaden in Spain, Idria in Austria, and of several localities in Cal.

Cinnamic Acid. $C_6H_5.CH{:}CH.COOH$. Mpt. 133°C. Phenylacrylic acid, crystallizing in white needles; occurring in Peru and Tolu balsams. It unites with bromine, forming phenyldibromproprionic acid.

Cinnamic Alcohol, or Cinnamyl Alcohol. $C_6H_5.CH{:}CH.CH_2OH$. Mpt. 33° C. Styrone. It occurs combined in storax; needles of hyacinth odor, easily oxidized to cinnamic acid.

Cinnamic Aldehyde. $C_6H_5.CH{:}CH.CHO$. Bpt. 247° C. Chief constituent of the oil of cinnamon, from which it is obtained; readily oxidized to cinnamic acid; a body of marked aromatic properties, which it imparts to the oils of cinnamon and clove.

Cinnamon. Aromatic bark of the small tree *Cinnamomum zeylanicum*, of the Laurel family, native of the E. Indies; cultivated in many varieties.

Cinnamon, Oil of. See Cinnamic Aldehyde.

Cinnamon Stone, or Essonite. Variety of garnet; named from its color.

Cino da Pistoia, ab. 1270–1337. Italian poet and jurist.

Cinosternidæ. Family of *Chelonia*, including *Aromochelys odoratus* and allied forms, all small turtles with a strong odor. The eggs have a brittle, glazed shell. The plastron has movable lobes, and is cruciform; the head is pointed.

Cinq-Mars, Henri Coiffier de Ruze, Marquis de, 1620–1642. Favorite of Louis XIII. of France, executed with De Thou for conspiracy against Richelieu; celebrated in De Vigny's romance.

Cinque Cento. 15th century art and literature, as opposed to the succeeding work of the Renaissance.

Cinque-foil. Species of the genus *Potentilla*, natural family *Rosaceæ*, mainly natives of the n. hemisphere; called also Five-finger; often represented in heraldry.—In Gothic architecture, ornament composed of five segments of circles.

Potentilla erecta.

Cinque Ports. Five ports on the s. coast of England, Dover, Hastings, Hythe, Romney, and Sandwich, to which Winchelsea and Rye were afterward added; established 1066 by William I. with special privileges on condition of furnishing ships and men for defense of the State; governed by wardens. Their jurisdiction was abolished 1835.

Cintra, Convention of. Aug. 1808, after the battle of Vimiera (q.v.). The French were allowed to leave Portugal with arms and property, and were conveyed to France in English ships.

Cionocrania. Procœlous lizards, including *Fissilinguia*, *Brevilinguia*, and *Iguana*.

Cipango, or Zipangon. Japan, as first made known to Europeans by Marco Polo.

Ciparin, Timoteo, 1805–1887. Roumanian grammarian, who wrote also on poetry and philosophy, and edited the national *Archives*, 4 v., 1870.

Cipolin, or Cipolino. Granular limestone, containing mica and talc; found in Italy.

Cippus. Stone post used in ancient Greece and Rome as boundary marks for land, or for monuments to the dead.

Cipriani, Giambattista, R.A., 1727–1785. Italian designer, in England from 1755.

Circassians, or Tcherkesses. Warlike tribe n. of the Caucasus, who long resisted Russia. Most of them migrated

Circassian.

to Asia Minor or Bulgaria 1860–65. Their daughters were long famed for beauty and sent to Turkish harems.

Circe. Sorceress, daughter of the Sun. She lived on Ææa, an island on which Ulysses was cast, and changed his companions into swine.

Circinnate. Method of vernation where the leaf is coiled from the apex to the base, uncoiling as it unfolds, as in the Ferns.

Circle. Plane curve, every point of which is equally distant from a point within, the center; the conic whose plane is parallel to the base of the cone. The area bounded by the curve is in elementary geometry called the circle, and the curve itself the circumference.

Circle of Perpetual Apparition. Small circle of the celestial sphere, parallel to the equator, the n. polar distance being equal to the latitude of the place. All stars within the circle are constantly above the horizon. An equal circle about the s. pole, within which all stars are constantly below the horizon, is called the circle of perpetual occultation. This definition applies to the n. hemisphere. In the southern the conditions are reversed.

Circles, GENERAL. Curves the equations of which have the form $y^{m+n}=x^m(a-x)^n$. If m=n=1, the curve is the common circle. If m is odd, the curve is an oval. If m is even, the curve has infinite branches and is hyperbolic.

Circuit. Judicial subdivision of the State. Circuit courts in the U. S. are common to the Federal and State judicial systems: their functions are prescribed by statute. A Circuit Court of Appeals was established by Congress 1891.—In Methodism, circle of stations supplied by an itinerant preacher.

Circuit, ELECTRIC. Path over which an electric current may pass. Any part of a circuit which returns upon itself so as to intersect is called a closed circuit.—MAGNETIC. Any space occupied by a magnetic substance, preferably iron, which concentrates the lines of magnetic force so as to cause them to return into themselves in closed curves. A horse-shoe magnet with an armature in contact with its poles furnishes an illustration of a closed magnetic circuit.

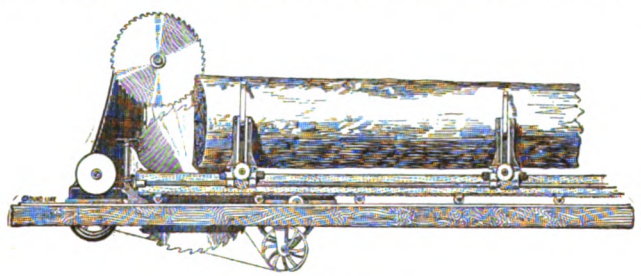
Circulant. Determinant, the first element in each row of which becomes the last element in the following row.

Circular Functions. Inverse of trigonometric functions; e.g., $y=\sin^{-}x$ is trigonometric: $x=\sin^{-1}y$. is circular.

Circular Mil. Area of a circle which has a diameter of a mil or 0.001 of an inch. Unit often employed in the measurement of the cross-section of wires for electrical purposes.

Circular Number. One, all integral powers of which end in the number itself; *e. g.*, 5.

Circular Saw. Steel disk, revolving around an axis, with a speed at the periphery of about 3,500 ft. per minute. In this periphery are cut the teeth, their shape differing according as the wood is to be slit lengthwise or cut across the grain. For large saws inserted teeth are often used; to prevent distortion and strains in the plate due to heat when at work, radial slots have been made which open and close as temperatures vary; for cutting grooves a wabbling saw has been used, the saw revolving around an axis to which its plane is inclined; dished



Circular Saw.

saws with curved plates are used for cutting staves and other curved work; plates of very thin gauge are used for resawing and for valuable lumber, the strength being given by a tapering flange of large diameter; some such saws are made up of a number of sectors, with copper strips dovetailed into the joints. Circular saws may be used in gangs to cut up a number of planks at once; the work may be fed to the saw, or, for cutting off, the saw may be fed to the work.

Circulating Capital. That which fulfills the whole of its office in the production in which it is engaged by a single use; *e.g.*, raw materials, or money paid out as wages. It is distinguished from Fixed Capital, in the form of buildings, machinery, and implements.

Circulating Decimal. One in which, after a certain point, one or more figures constantly recur in the same order, forming the repetend.

Circulating Medium. That which passes generally current in any community, fulfilling the ordinary functions of money.

Circulating Pump. Pump which circulates the cold water in the SURFACE CONDENSER (q.v.) of a condensing steam engine. Where sea water is circulated, the pump has often been of centrifugal type; the newer practice favors an independent steam pump, which operates the air-pump as well.

Circulation in Boilers. Motion of the water in hot boilers; due to two causes: (1) The cold water, being denser than that warmed at the most active heating surface, tends to sink and displace that warmed water upward. (2) After the water is hot enough to form steam, the bubbles of steam-gas form at the bottom and through the mass, and hasten to rise to the surface. They rise most actively where the boiler shell and the water are hottest. Hence the currents will be upward over or near the fire, and downward at the back end furthest from the fire. In inclined tubes, the upward current is at the upper side, the downward at the bottom. In vertical tnbes the circulation is variable and vacillating. unless directed in one way as in the FIELD TUBES (q.v.). Ample disengagement area for the steam-gas bubbles from the water is a condition of normal circulation. Defective circulation leads to overheating of plates, when steam keeps the cooling water from the metal.

Circulation of the Blood. Passage of the blood through the heart, lungs, arteries and veins, demonstrated by Wm. Harvey, an English anatomist, in 1628. Starting from the left auricle the blood passes into the left ventricle, thence through the aorta, arteries and veins to the right auricle, from which it enters the right ventricle, which forces it through the lungs, by means of the pulmonary artery and branches, where it receives oxygen and gives off carbonic acid gas. After aeration it returns to the point of starting through the pulmonary veins and their branches. A portion passes through the vessels of the stomach, intestines, pancreas, spleen, and liver, taking up a portion of the food and modifying it preparatory to its distribution. In the fœtus but little blood passes through the lungs; oxygen and nutriment being derived by osmosis from the maternal blood, the carbonic acid being removed in the same manner. The blood passes from the right auricle, by a special opening, afterward closed, to the left auricle and so on. See CAPILLARIES.

Circulation of Wealth. Passage of commodities or of their ownership from one person to another. It is one of the most important elements of a high economic organization, accompanying all division of labor and complexity of processes of production.

Circumcision. Rite practiced by Abraham and his descendants, and largely by other Eastern tribes; cutting off the foreskin of male children, among the Jews a week after birth. Apart from its sanitary value, it had a symbolical meaning similar to that of baptism.

Circumcision, FEAST OF. Jan. 1; traceable to 5th century.

Circumdenudation. Wasting on all sides of a mass of rocks, leaving the remainder to stand at or near its original altitude. See OUTTIER.

Circumference, or PERIPHERY. Curve inclosing a circle or other plane figure.

Circumnavigation of the Globe. First accomplished by Elcano, Magellan's lieutenant, 1519–22; later by Drake, 1577–80, and many others.

Circumnutation. Revolving motion of the apex of a growing vegetable organ.

Circumœsophageal Nerve Commissure. Ring of ganglia and nerves surrounding the œsophagus near the mouth in different arthropods and worms.

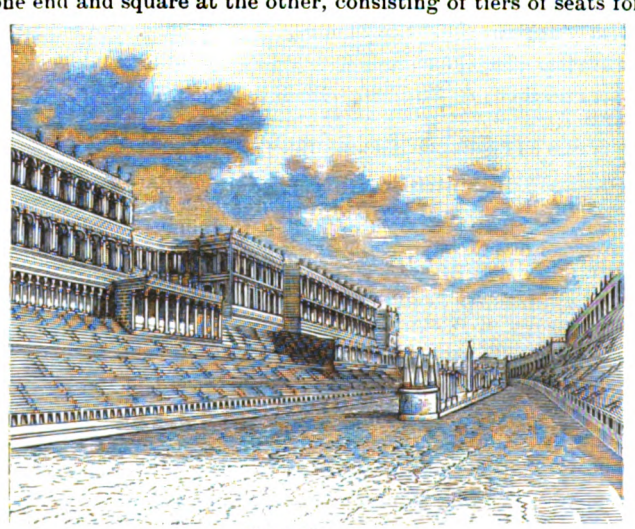
Circumoral. Encircling the mouth or œsophagus.

Circumscissile. Dehiscence of a capsule or seed-vessel in a transverse manner, so that the top falls off as a lid, as in Purslane.

Circumscript Ambulacra. See PETALOID AMBULACRAL ZONES.

Circumvallation. Line of works surrounding the rear and flanks of an army engaged in laying siege to a position, in order to protect it from sudden attack by a relieving force.

Circus. In ancient Rome an oblong building rounded at one end and square at the other, consisting of tiers of seats for



Circus Maximus.

the spectators and an open space for chariot races, combats of animals, and other games. At the square end was the stall

from which the chariots were started. There was a long wall down the center, terminated by pillars, marking the goals. The Circus Maximus at Rome is the most famed of these constructions. In its greatest extent, as finally enlarged, it is said to have held 385,000 spectators. In the time of Julius Cæsar the inner space was 1,875 ft. long and 625 ft. wide. The surrounding building was 312 ft. wide. The Circensian Games were celebrated annually, and were said to date from Romulus. Battles and even sea-fights were sometimes represented. The Circus of Maxentius, 2 miles from Rome, on the Appian Way, remains in a fair state of preservation. Pompey, at the opening of his new theater, gave exhibitions in the Circus for 5 days, during which 500 lions and 20 elephants were destroyed.

Cirillo, DOMINICO, 1734–1799. Neapolitan physician, author, patriot, and martyr.

Cirque. Semicircular excavation in a glaciated region. Much controversy has taken place regarding the origin of cirques, but they are probably produced by the erosion caused by the down-slipping of large masses of snow, accumulated in pre-existing recesses on the mountain side. Cirques are seldom glaciated except at their very bases, where frequently lie small mountain lakes.

Cirrhiferous. Tendril-bearing, as the leaves of the Pea.

Cirrhose. Bearing or resembling tendrils.

Cirrhosis. Chronic inflammation of the areolar tissue, which binds together the special elements of glands; resulting in a marked diminution in their size; most common in the liver and kidneys, being usually due to abuse of alcohol, but sometimes occurring in the lungs and nervous centers, and as a rule fatal. Called Hobnail Liver in that organ.

Cirrhus. Tentacle at the dorsal, and one at the ventral, side of the parapodium of an Annelid.

Cirri. Brush-like, curled, slender processes, as the feet of Barnacles, processes on the arms of Brachiopods, and on the dorsal side and on the stalks of Crinoids, by which they can anchor themselves. Also tactile hairs on the segments of annelid worms. Also the protrusible part of the vasdeferens in Trematodes and Tapeworms.

Cirripedia (ANCHORACEPHALA, or BARNACLES). Small *Crustacea*, inclosed in a shell of five or more pieces. Usually fixed to some object by the back, in the head region, with the six pairs of biramous thoracic appendages protruding upward through the slit of the shell. They are mostly hermaphrodite; some are parasites and degraded. When first known they were thought to be young birds (geese). They form the groups *Pedunculata*, *Operculata*, *Abdominalia*, *Apoda*, and *Suctoria*.

Cirrobranchiata. See SCAPHOPODA.

Cirro Filum. Long, thin stripes of cirrus, apparently at the same level. These move at an angle with the isobars, and are important indicators of coming weather changes.

Cirrostomi. See LEPTOCARDII.

Cirrus. Delicate form of cloud, having a wispy, feathery, or curly appearance. See CLOUDS.

Cirrus. See CIRRI.

Cirrus Sac, or SHEATH. Sac into which a cirrus is withdrawn.

Cirrus Stripes, or STRIÆ. See CIRRO FILUM.

Cisalpine Republic. Formed July 1797 by union of the Cispadane and Transpadane States, created by Bonaparte May 1796. In 1802 it became the Italian Republic; 1805–14 it was the kingdom of Italy, under Napoleon. Milan was the capital.

Cissey, ERNEST LOUIS OCTAVE DE, 1810–1882. French General; Minister of War 1871–76.

Cissoid of Diocles. Historic curve, used to obtain geometrically two mean proportionals between two given lines. It is the locus of the intersections of secants from one extremity of the diameter of a circle to the extremities of a chord perpendicular to that diameter, with a parallel chord equidistant from the center. Its rectangular equation is $y^2=\frac{x^3}{2r-x}$; its polar equation is $\rho=2\ r\ \mathrm{Sin}\ \theta\ \mathrm{Tan}\ \delta$.

Cistaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 4 genera and ab. 100 species, distributed throughout the temperate regions of the n. hemisphere.

Cistenchym. Tissue near the epidermis of geodinid and tetractinnellid sponges; composed of vacuolated cells resembling plant cells, which perhaps are a sort of THESOCYTES (q.v.).

Cistercians. Monastic order, founded 1098 at Citeaux, in France, by Robert, abbot of Molesme, for the reformation of

St. Bernard and Cistercians.

the Benedictines; illustrious through St. Bernard, who joined it 1113. The Port Royal ladies were Cistercian nuns.

Cistern. Vault for storing rain water, usually built in the ground. Great care is necessary that it should not be contaminated with cesspool or kitchen drainage. The water of properly constructed cisterns is generally of good quality.

Cistome. Intercellular space immediately beneath a stoma.

Citadel. Strong bastioned work having a command over the main defensive works surrounding a town. It is designed to prolong the defense after the capture of the main work.

Citation. (1) Summons to appear in court. (2) Reference or quotation.

Cithæron. Range of mountains between Attica and Bœotia, sacred to Bacchus and the Muses.

Cithara. Ancient stringed instrument, similar to the guitar.

Cities of Refuge. Asylums for the accidental homicide, provided by the Levitical law, three on each side of Jordan.

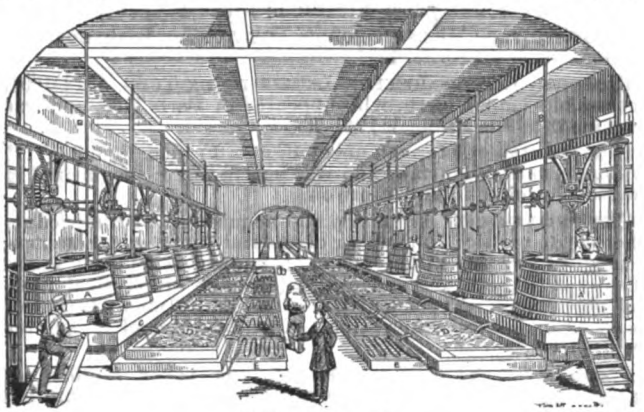
Cities of the Plain. Sodom, Gomorrah, Admah, and Zeboiim, in the deep depression of the Dead Sea, destroyed for their wickedness.

Citigradæ. See SPIDERS.

Citizen. Member of a State; one owing allegiance to the State, which guarantees to him certain privileges. In the U. S. a person may be a citizen of a particular State without acquiring Federal citizenship; but the U. S. Constitution guarantees to the national citizen certain rights which the States cannot abridge. Citizenship in the U. S. may be acquired by birth or by naturalization.

Citric Acid. $C_3H_4(OH)(COOH)_3$. Mpt. 153° C. Solid tribasic acid crystallizing in rhombic prisms, soluble in water. It occurs in lemons, oranges, and other acid fruits, is prepared from lemon and lime juice by neutralization with chalk and de-

composition of the lime salt with sulphuric acid; it is used in cotton printing, in the treatment of scurvy, and in the prep-



Citric Acid Works.

aration of effervescing drinks and fruit syrups. Lemon and lime juice contain from 9 to 13 oz. of free acid per gallon. On heating it yields aconitic acid.

Citrine. Yellow quartz, resembling topaz.

Citron. Small thorny tree of the Orange family, cultivated

Citron (*Citrus medica*):
a, fruit; *b*, transverse section of fruit.

for centuries in Asia and Europe for its fruit, which is prepared as a sweetmeat. Citron oil is obtained from its rind.

City. In English law, an incorporated town which is or has been the see of a bishop; in the U. S., one so designated by the State. Its local government is generally vested in a Mayor and Board of Aldermen.

City Engineering. Construction of streets, drains, sewers, and water supply systems, and all the miscellaneous work relating to boundaries and street lines. The design and execution of all these constructions requires talent, education and experience of a high order. In a large city the work is subdivided into distinct departments with a civil engineer at the head of each.

City Point. In Va., on the James, at the mouth of the Appomattox. It was seized by Gen. Butler in his movement up the James in May, 1864, and in June became the headquarters of Gen. Grant and the chief depot of supplies for his army. Pop., 1890, 409.

Ciudad Rodrigo. Fortified town in w. Spain; surrendered to the French July 10, 1810; stormed by the British under Wellington, Jan. 19, 1812. Pop., 1887, 8,330.

Civet. See VIVERRIDÆ.

Civil Damage Acts. Statutes creating a cause of action in favor of those who sustain injury to person, property or means of support, by reason of the intoxication of another, against any one contributing to such intoxication by selling or giving liquors.

Civil Death. Extinction of a living person's civil rights. At common law it occurred whenever one became a professed monk, or abjured, or was banished the realm. Imprisonment for life does not work complete civil death in the U. S.

Civil Engineering. This profession has for its object the economic construction of public works, such as roads, canals, harbors, and water supply systems. Although such works have been constructed from remote antiquity, it is only during the present century that proper consideration has been given to strength and economy. The Pyramids and irrigating canals of Egypt, the roads and aqueducts of the Romans, and other great works executed 2,000 years ago, show that the methods of excavating earth and of quarrying and handling stone on a large scale, though well known, were in general those of unskilled labor, earth, *e.g.*, being carried in baskets, and stones polished by hand rubbing. The direction of these works was usually military, and the labor was performed by soldiers and slaves, with little regard for economy. Indeed the charge of engineering operations was generally in the hands of army officers until the beginning of the 19th century, when the word "civil" was introduced in contradistinction to military. The introduction of railroads, ab. 1825, opened a wide field in constructions of a new kind, involving tracks, culverts, bridges and rolling stock. As railroads were built by private corporations and not by the government, and for the purpose of profit, economic questions were the first to receive attention, and hence arose the study of the mechanics of structures and of the strength of materials. Since 1850 the progress of civil engineering has been particularly marked, hundreds of technical schools having been established to teach its principles and methods, and in the U. S. alone thousands of trained men are practicing the profession, which is now so extensive as to require subdivision into special departments, as bridges, canals and rivers, water supply and irrigation, railroads, and sanitary engineering. Common to all branches are surveying, drawing, the strength of materials, the computation of stresses, and hydraulics. In this cyclopœdia nearly 1,000 articles are devoted to civil engineering subjects.

Civil Engineering Societies. The oldest is the Institution of Civil Engineers, London, founded by Telford 1818, and now having ab. 7,000 members of all classes. The oldl est and largest in the U. S. is the American Society of Civi-Engineers, founded 1852; its membership in 1894 was 1,736; its headquarters are in New York, where it has a house and a valuable library, and it publishes monthly Transactions and Proceedings, forming 3 vols. each year. Numerous other societies and clubs of State or local character exist, and several of these have united in publishing the Journal of the Association of Engineering Societies.

Civilization. Social, industrial, intellectual, and moral condition of mankind, represented in various stages of development above savage life. It is mainly characterized by tendencies to the suppression of war, by respect for humanity, and by voluntary effort of some kind at the improvement of human welfare.

Civilized Warfare. The methods of conducting war among civilized nations have reached a degree of uniformity which, in contrast to the methods practiced by savage tribes and in former ages, is favorable to the interests of humanity, in the humane treatment of prisoners, granting quarter to the captured even in cases of extreme and unwarrantable resistance, and in a recognition of the rights of non-combatants, women, and children.

Civil List. Formerly including all the expenses of the British Government, it now covers only that sum voted to the Sovereign on accession in exchange for the revenues of Crown Lands. The money is applied to the maintenance of the Royal Household. Queen Victoria's civil list was fixed at $1,925,000 per annum.

Civil Service Reform. Attempts to abolish the "spoils system," by which office-holders were turned out to make room for the supporters of the successful political party, ended in England in the examination of the fitness of nominees 1855, known as "pass examinations," followed by open competitive examinations 1870. In the U. S. the introduction of the system by President Grant 1872–74 met with determined opposition in Congress, and in spite of the efforts of succeeding Presidents no real progress was made till the passage of the Civil Service Act 1883. Besides establishing competitive examinations this Act prohibited political assessments. The Classified Service created by the Act includes the Executive Departments at Washington, the Department of Labor, the Fish Commission, the Civil Service Commission, the Weather Bureau, 11 customs districts containing 50 or more employés, 610 free-delivery post-offices, the Railway Mail Service, and the Indian School Service. These comprise ab. 43,000 places, one-fourth of the whole number. The Classified Departmental Service includes all places in the Washington Departments except messengers, laborers, workmen and watchmen, and excepting officers appointed by the President with the advice and consent of the Senate. In the Classified Customs Service are included all posts of $900 a year and over not subject to confirmation by

the Senate. The Classified Postal Service includes all but the postmasters and laborers. The Classified Railway Mail Service embraces all employés, and the Classified Indian Service includes all physicians, school superintendents and assistant superintendents, school-teachers and matrons in the Indian Service. Special examinations are held when technical qualifications are requisite, as in the State Department, Pension, Patent, Weather and Signal Offices and Geological and Coast Surveys. In 1895 applicants for Consular appointments, $1,000 to $2,500 salary, were required to pass examinations.

Civitali, 'MATTEO, 1435–1501. Italian sculptor and architect. The Cathedral of Lucca retains much of his work.

Civita Vecchia. Free port of Italy, 36 m. n. of Rome; founded by Trajan, who constructed its harbor; taken by the

Civita Vecchia.

French 1849. It is famous for its oysters, which are very small, but delicious to the taste. Sometimes called Portus Trajani. Pop. ab. 13,000.

Cladocarpous. Mosses which bear their sporanges on short lateral branches.

Cladocera (WATER FLEAS). Phyllopods inclosed in a bivalve shell, except the head. They have two large posterior antennæ, used in swimming, and four to six pairs of swimming feet. The compound eyes are often fused on the median line. A looped shell-gland is always present. Parthenogenetic "summer eggs" appear under favorable conditions of nutrition, but under reverse conditions "winter eggs" and males are produced. The brood pouch lies in the back. They usually live in fresh water and swim with a jerky motion. *Daphnia*, with biramous swimming antennæ, is an example.

Cladodus. Type of shark's teeth, containing one long denticle with one or more smaller ones on each side of it. This genus was known only by its teeth until recently, when specimens found in n.e. Ohio have thrown much light on its appearance and structure. Several species have been distinguished, varying in size and form of the teeth. The largest yet known probably did not exceed 15 ft. in length.

Clodome. Branches on the end of a sponge spicule, considered together.

Cladophoraceæ. Order of green Algæ (*Chlorophyceæ*), the species occurring both in fresh and salt water.

Cladothrix. Filamentous bacteria that present an appearance of branching during quiet growth.

Cladotrichaceæ. Order of *Schizomycetes*, having branched filaments.

Claiborne, or CLAYBORNE, WILLIAM, ab.1589–ab.1676. Colonist of Va. who planted Kent Island in Chesapeake Bay, refused to acknowledge Lord Baltimore's patent of 1632, and gave the authorities of Md. much trouble. His "Rebellion" was subdued 1635, but under the Commonwealth he drove out the Calverts, and held Md. 1652–58.

Claim. In Cal., any piece of ground belonging to the public domain, but occupied, for mining purposes, in conformity with local law and usage, by a single person or an association. The amount that may be included, and the conditions on which possession may be retained, have been fixed from time to time by judicial decisions and by statutes based on local customs.

Clairaut, ALEXIS CLAUDE, 1713–1765. French mathematician and physicist; Academician 1731. *Figure of the Earth*, 1743; *Theory of the Moon*, 1752.

Clairin, GEORGE JULES VICTOR, b. 1843. French painter.

Clairmonte, MRS. ("GEORGE EGERTON"). Irish novelist. *Keynote*, 1892; *Discords*, 1894.

Clairon, CLAIRE JOSEPHE LEGRIS DE LA TUDE, 1723–1803. Actress of Flemish birth, who appeared in Paris 1736, and was prominent at the Français 1743–65.

Clairvaux. Cistercian abbey in n. e. France, founded 1115 by St. Bernard, who ruled and was buried there; secularized in the Revolution, and now a prison.

Clairvoyance. Popularly the acquisition of knowledge, whether of physical objects or of mental facts, which is independent of any sense impressions as known to science; scientifically it is the transcendental knowledge of physical facts and phenomena independently of sense limitations whether of space or of sensory impressions. The existence of it requires proof.

Clam. See VENERIDÆ, MYIDÆ, and other families of Lamellibranchs. For the clams of fresh water, see UNIONIDÆ.

Clamatores. Gallinaceous birds (see GALLINACEI); also a group of Passerine (see PASSERES). Birds whose note is a shriek rather than a musical tone. Dentirostral forms are the TYRANNIDÆ (q.v.), Conirostral, the Lyre-bird of Australia, and Tenuirostral, the ANABATIDÆ (q.v.).

Clan. Confederation of descendants of a common ancestor. In Scotland clans arose ab. 1008. They were essentially lawless and predatory, and the Lowlands suffered for centuries from their raids. In consequence of the Rebellion of 1745 the power and heritable jurisdiction of their chiefs were finally abolished in 1747. The clans were 45 in number, distinguished by a different plaid and badge.

Clanny Lamp. See SAFETY LAMP.

Clap, THOMAS, 1703–1767. Pres. Yale College 1740–66, and its historian 1766; maker of the first American planetarium. *Meteors*, 1781.

Clapperton, HUGH, R.N., 1788–1827. Scottish explorer in Africa.

Claque. Company of men trained and paid to applaud in theaters; organized in Paris ab. 1810, but in substance much earlier.

Clara, or **Clare,** ST., 1194–1253. Founder 1212 of an order of Franciscan nuns, now called the Poor Clares; canonized 1255.

Clare, JOHN, 1793–1864. English plowman and poet. *Village Minstrel*, 1821; *Rural Muse*, 1835.

Clarence, DUKE OF. Title of some English princes.—GEORGE, brother of Edward IV., son-in-law of Warwick, was charged with treason and executed 1478. Unsupported tradition states that he was drowned in a butt of Malmsey wine.

Clarendon, CONSTITUTIONS OF. Sixteen ordinances enacted by Henry II. and a general council of barons and prelates, at Clarendon 1164. The most famous provision was that subjecting the clergy in criminal cases to the jurisdiction of the civil courts.

Clarendon, EDWARD HYDE, EARL OF, 1609–1674. English royalist of moderate opinions, but faithful to Charles II. in exile;

made Lord Chancellor and Prime Minister at the Restoration, and ennobled 1661; deposed and impeached 1667, as guilty of his master's faults; father-in-law of James II., and grandfather

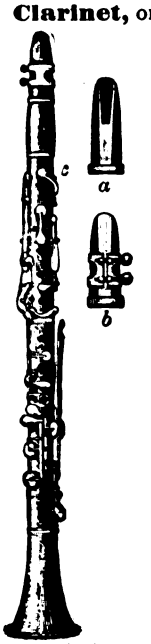
of two queens. His *History of the Rebellion*, pub. 1702–17, is still highly valued.

Clarendon, GEORGE WILLIAM FREDERICK VILLIERS, EARL OF, 1800–1870. English diplomatist; Ambassador to Spain 1833; Lord Privy Seal 1840; Lord Lieutenant of Ireland 1847; Sec. of Foreign Affairs 1853–58, 1865–66, and 1868–70. He secured the alliance with France, and promoted the Crimean war.

Claretie, JULES (orig. ARSENE ARNAUD), b. 1840. French novelist, dramatist, critic, and historian, director of the *Comédie Francaise* since 1885. *Pierille*, 1863; *Mlle. Cachemire*, 1865; *Un Assassin*, 1866; *Derniers Montagnards*, 1867; *Revolution of 1870–1*, 5 vols.

Clarification. Process of changing a fluid from a turbid to a clear condition. This is done by filtering through cloth, sand, charcoal, by centrifugal force and by the addition of various substances. In waters containing organic matter alum is used. In liquors, albumen, whites of eggs, isinglass, gelatine or milk.

Clarinet, or CLARIONET. Musical instrument of the reed family, supposed to have been invented by Denner in Nuremberg ab. 1690. It is useful in the orchestra, and has a compass of over three octaves. The tone is produced by a single flat reed vibrating against the mouth-piece, a conical stopper cut off obliquely on one side and flattened on the other, against which the reed is fastened. Composers extend the compass by using instruments of different sizes. It came into general use after 1800.



Clarinet:
a, mouthpiece, back view, with reed removed; *b*, the same with reed attached.

Clark, ALONZO, 1807–1887. Eminent American physician and teacher of medicine in Coll. Phys. and Surg., N. Y., of which he was for many years pres., prominent for his skill in diagnosis and as a lecturer.

Clark, ALVAN, 1804–1887. With his sons, GEORGE BASSETT, 1827–1891, and ALVAN GRAHAM, b. 1832, most successful makers of large refracting telescopes, among others the Pulkowa glass, 30 in., the Lick, 36 in., and the Yerkes, 40 in. clear aperture.

Clark, SIR ANDREW, M.D., LL.D., F.R.S., b. 1826. Scottish physician and medical writer; Baronet 1883.

Clark, FRANCIS EDWARD, D.D., b. 1851. Pastor at Portland, Me., 1876, and S. Boston 1883–87; founder of the Christian Endeavor Society 1881, and its pres. 1887; ed. *Golden Rule*.

Clark, GEORGE ROGERS, 1752–1818. Conqueror of the French northwest. In 1778, with a commission from Gov. Henry of Va., he descended the Ohio, founded Louisville, Ky., and took Kaskakia, Ill. Feb. 24, 1779, with 170 men, he took the fort at Vincennes, Ind. His later years were spent in neglect and poverty. His brother WILLIAM, 1770–1838, with CAPT. M. LEWIS (q.v.), led an expedition to the Pacific 1804–5, and was Gov. of Mo. 1813–21.

Clark, JOHN B., b. 1847. American political economist, Prof. Smith College 1882, and subsequently at Amherst, Johns Hopkins, and Columbia.

Clark, LEWIS GAYLORD, 1810–1873. American essayist; ed. *Knickerbocker Mag.* 1833–59. His twin brother, WILLIS GAYLORD, 1810–1841, wrote verse and ed. Phila. *Gazette*.

Clark, NATHANIEL GEORGE, D.D., LL.D., b. 1825. Prof. Univ. Vermont 1853–63; Union Col. 1863; For. Sec. A.B.C.F.M. from 1865. *Elements of English*, 1863.

Clark, THOMAS MARCH, D.D., LL.D., b. 1812. Bp. of R. I. 1854. *Primary Truths of Religion*, 1869; *Reminiscences*, 1895.

Clark, WILLIAM GEORGE, 1821–1878. English author; ed. *Cambridge Shakespeare*, 1863–66; *Middle Ages*, 1872.

Clarke, ADAM, LL.D., ab. 1762–1832. B. in Ireland; thrice pres. English Wesleyan Conference; a prolific writer, best known by his *Commentary on the Bible*, 8 vols., 1810–25.

Clarke, SIR ANDREW, b. 1824. English general and colonial official.

Clarke, CHARLES COWDEN, 1787–1877. English writer on Shakespeare. His wife, MARY COWDEN (Novello), b. 1800, m. 1828, bore part in his labors, and prepared a well-known *Concordance to Shakespeare*, 1845.

Clarke, EDWARD DANIEL, LL.D., 1769–1822. Prof. Cambridge 1808. *Travels*, 6 v., 1810–23.

Clarke, FRANK WIGGLESWORTH, B.S., b. 1847. American chemist. Prof. Howard Univ. 1873–74; Prof. Univ. Cincinnati 1874–83; Chief Chemist U. S. Geol. Survey since 1883. *Elements of Chemistry*, 1884.

Clarke, HUGH ARCHIBALD, b. 1839. Prof. Univ. Penn. 1875; composer of *Jerusalem*, an oratorio, incidental music to Aristophanes' *Acharnians*, and a cantata, *Prometheus*.

Clarke, JAMES FREEMAN, D.D., 1810–1888. Unitarian pastor in Boston from 1841. *Orthodoxy*, 1866; *Ten Great Religions*, 1870–83; *Thomas Didymus*, 1881; *Autobiography*, 1891.

Clarke, JOHN MASON, b. 1857. Prof. of Geology at Smith Col., 1881–84, and at Amherst Agricultural Col., 1884–86; assistant Paleontologist of N. Y. 1886.

Clarke, JOHN SLEEPER, b. 1834. American actor and manager, known in comic parts from 1851; since 1867 mainly in England.

Clarke, MCDONALD, 1798–1842. American, called "the mad poet."

Clarke, SAMUEL, D.D., 1675–1729. English philosopher; rector in London from 1709. He ed. Homer, defended Sir I. Newton's tenets, was eminent in logic and metaphysics, and held semi-Arian opinions. *Being and Attributes of God*, Boyle Lectures, 1704–5; *Scripture Doctrine of the Trinity*, 1712.

Clarke, SAMUEL, D.D., 1684–1750. English dissenter. *The Saints' Inheritance;* being a collection of the promises of Scripture.

Clark's Fork. Branch of Snake R. It collects its waters from many branches in Montana, Idaho and British Columbia, flows in a tortuous course across Wash. to its junction with the Snake near the s. boundary. The drainage area is 63,291 sq. m.; though less than that of the Snake, its volume of water is much greater, owing to the abundant rainfall within its area.

Clarkson, THOMAS, 1760–1846. Pres. English Anti-Slavery Society 1823. He procured, with Wilberforce, the abolition of the slave trade, of which he pub. a *History*, 1808, and in 1833 that of slavery in the W. Indies.

Clark University. Founded 1887 at Worcester, Mass., by Jonas C. Clark, opened Oct. 1889. G. Stanley Hall is its pres. Its chief purpose is the promotion of original and independent research. It has departments of mathematics, physics, chemistry, biology, and psychology, and occupies itself with post-graduate work. No clearly marked line exists between students and instructors. Fellows and scholars who have attained some degree of mastery in a special line of work give brief special courses. The highest annual appointment is that of Docent. These positions are primarily honors, and are reserved for a few men whose work has already marked a distinct advance beyond the doctorate, and who wish to engage in research. The highest formal honor is *Licentia docendi*, which is intended to be a "brevet collegiate professorship." The library consists of special collections, and contains 15,500 v.

Claspers. Appendages in *Crustacea*, modified in the male for holding the female.

Classical. This epithet in music has the same vagueness of meaning that it has in literature. Generally it is held to characterize the works of acknowledged masters at a time when form was treated with more, or at least as much, respect as contents; also, new works written in conformity to the older laws. See ROMANTIC.

Classics. Greek and Latin writings prior to the periods of decadence. Loosely, the more valued older works in English or other literature.

Classification. Second element of scientific method, observation being the first. It is the process of reducing individual facts and things to their genera, to be dealt with as wholes in generalization. Natural classification indicates the genetic relationship of biological objects. Animals and plants are distinguished as species, genera, families, orders, classes, and subkingdoms. It is largely arbitrary what shall distinguish any grade of this series; ordinal characters of one class are not always of the same grade with those of another. Agassiz thought that each division was fixed, having been preconceived by the Creator. According to the Darwinian hypothesis, varieties are incipient species, species, incipient genera, etc., hence the conflicting classificatory systems and the difficulty of arranging groups in a definite way. We are always finding "connecting links" that unite into one group, with subgroups, what before were different groups. See HYBRIDIZATION.

Classis. Governing body midway between consistory and synod, in Reformed Ch. in Holland and U. S.; equivalent to presbytery.

Class Meeting. Methodist institution, begun by Wesley 1742; weekly meeting of a class, *i.e.*, a number of persons placed under the charge of a class-leader, male or female, for special care of their spiritual state.

Clastic. Rocks made of fragmentary material.

Clathrate. In Botany, lattice-like structures.

Claude, JEAN, 1619–1687. French Protestant, exiled 1685; active and prominent in controversy. *Defense of the Reformation*, 1673; *Complaints of the Protestants*, tr. 1686. His *Essay on the Composition of a Sermon* was long and highly valued.

Claude Lorrain (GELLEE), 1600–1682. French landscape painter, active in Italy; unsurpassed and rarely equaled, even in 17th century art; specially famed for effects of sunlight. His subjects generally were ostensibly classical and imaginative. Paintings in the Doria and Sciarra Palaces at Rome.

Claude Lorrain.

Louvre, Paris; Hermitage, St. Petersburg; London and Dresden. The paintings of Turner were willed to the National Gallery of London on condition that a Turner landscape should hang beside a C. The *Liber Veritates*, owned by the Duke of Devonshire, is a series of sketches recording C.'s work between 1634 and 1675.

Claudianus, CLAUDIUS, d. ab. 408. Last important classic Latin poet. Two epics and several panegyrics survive.

Claudius, APPIUS. Decemvir of Rome 451 B.C. His attempt to enslave the daughter of Virginius has been made famous by Livy and Macaulay.

Claudius, APPIUS CÆCUS. Censor 312 B.C.; twice consul; earliest known Roman author. He built an aqueduct and began the Appian Way.

Claudius, MARCUS AURELIUS, 214–270. Roman emperor 268; called Gothicus from his victory over the Goths 269.

Claudius, MATTHIAS, 1740–1815. German sacred poet of wide influence. His writings filled 8 vols., 1785–1812.

Claudius of Turin, d. 839. Italian bishop of Spanish birth, active as a doctrinal reformer.

Claudius (TIBERIUS CLAUDIUS DRUSUS NERO GERMANICUS), B.C. 10–54. 4th Roman emperor, son of Drusus and nephew of Tiberius; author of works now lost; enthroned by the prætorians 41; husband of Messalina, whom he executed for her shameless vices, and of his niece Agrippina, who poisoned him.

Clausen, HENRIK NIKOLAI, 1793–1877. Danish rationalist, Prof. Univ. Copenhagen 1822–74; active in public affairs. *Romanism*, 1825; *The Reformation*, 1836; *Dogmatics*, 1867.

Clausewitz, KARL VON, 1780–1831. German military writer.

Clausius, RUDOLF JULIUS EMANUEL, 1822–1888. Prof. Zurich 1857, Bonn 1869; writer on mathematical physics, optics, electricity, and thermodynamics, of which he was one of the founders.

Clausson, PEDER, 1545–1614. Norwegian author; tr. Sagas.

Clavarieæ.

Clausthalite. PbSe. Lead selenide, first found in the Hartz Mts.

Clavarieæ. Family of Fungi, of the order *Hymenomycetes*, including many branching forms found on the ground in woods, having the hymenium on the surface of the branches.

Clavate. In Botany, club-shaped organs.

Clavecin. See PIANOFORTE.

Clavellina. See ASCIDIANS.

Claverhouse. See GRAHAM, J.

Clavicembalo. See PIANOFORTE.

Clavichord. See PIANOFORTE.

Clavicle. The collar-bone of man is represented in all classes of vertebrated animals, as the anterior of the two ventral bones of the shoulder girdle (pectoral arch), the posterior being the coracoid, the dorsal one the scapula or shoulder-blade. In Fishes the clavicle is larger than the coracoid and usually fused to it. In Birds the clavicles unite ventrally and constitute the wish-bone (furcula), the coracoids being very much developed and alone supporting the breastbone. In Mammals the coracoid is reduced to a process of the scapula; and in the hoofed animals and *Carnivora* the clavicle is rudimentary or absent.

Clavicularia. Side pieces of the turtle's plastron.

Clavicymbalum. See PIANOFORTE.

Clavidæ. Family of *Tubulariæ*, of which *Cordylophora* is the type. This is a branched hydroid colony, with sessile gonophores that are inclosed in the perisarc. They live in fresh or brackish water, and are diœcious.

Clavigero, FRANCISCO XAVIER, 1731–1787. Mexican Jesuit, exiled 1767; historian of the Aztecs 1780, and of California.

Clavijo, RUY GONZALES, d. 1412. Spanish envoy to Samarcand 1403–6. *History of Tamerlane*, pub. 1582, tr. 1860.

Clavula. Knobbed and ciliated bristle; also a sponge spicule, similar in shape, found in the genus *Farrea*.

Claw. Narrowed base of a petal or sepal.

Clay. Product of decomposition of feldspathic rocks; hydrous aluminum silicate (kaolinite) mixed with various kinds of mineral and organic matter, especially calcium and magnesium carbonates, sand, and hydroxides of iron. Some of these affect its value for industrial uses. Clays differ in physical structure, in plasticity, and in ability to withstand heat without fusion. Good clays are found in nearly all the geological formations, and are designated by the uses to which they are put, as china clay, brick clay, fire clay, etc., and are used for making bricks, earthen ware and pottery. N. Y. and N. J. contain valuable deposits. Clay soils, though usually containing plant-food in abundance, are not easily worked, are retentive of water, and often lacking in organic matter. When once clay soils are brought under subjection by plow and harrow, the surplus water removed by drains, and some decaying vegetable matter added, they become the most productive of soils. They call for more skillful treatment by the farmer than any other class. See KERAMICS, BRICKS.

Clay, CASSIUS MARCELLUS, b. 1810. Kentuckian, noted as an opponent of slavery; Minister to Russia 1863–69.

Clay, CLEMENT COMER, 1789–1866. M.C. 1829–35, Gov. Ala. 1835, U. S. Senator 1835–41.—His son, CLEMENT CLAIBORNE, 1819–1882, was U. S. Senator from Ala. 1854–61.

Clay, HENRY, 1777–1852. U. S. Senator from Ky. 1806, 1809–11, 1831–42, 1849–52; M.C. 1811–21, 1823–25, and generally Speaker; U. S. Sec. of State 1825–29; presidential candidate 1824, 1832, 1844, and 1849. He was prominent in Whig counsels and in public affairs for forty years, especially in the Pacification of Ghent 1815, in tariff measures, and in the Missouri Compromise 1850. Webster alone excelled him in oratory and in statesmanship.

Clay Ironstone. (1) Argillaceous hematite. (2) Mixture of clay or sand with siderite, common in the carboniferous formation. (3) Brown clay ironstone, containing limonite.

Claymore. Scottish broadsword.

Claypole, EDWARD WALLER, b. 1835 in England. Paleontologist to the 2d Geological Survey of Pa. 1881–83; chiefly engaged in the study of Silurian and Devonian Fossil Fishes of America; prof. Antioch Col. 1873–81, Buchtel Col. 1883–86.

Clays, PAUL JEAN, b. 1819. Belgian marine painter.

Clay Slate. Fine grained, firm, variously colored rock, consisting essentially of clay that, under the action of heat and pressure, has consolidated and has acquired a marked cleavage structure; used for roofing, and as a building material in other ways; sometimes ground for a pigment. In the U. S., Pa. and Vt. are the largest producers. The quarries of Wales have a wide reputation. Value of product in U. S. in 1889 was $2,797,904.

Clayton, JOHN MIDDLETON, LL.D., 1796–1856. U. S. Senator from Del. 1829–37, 1845–49, and 1851–56; Chief-justice of Del. 1837–40; U. S. Sec. of State 1849–50; Whig leader.

Clayton-Bulwer Treaty. Between Great Britain and the U. S.; signed at Washington April 19, 1850. It guaranteed the neutrality of a ship-canal across the Isthmus of Panama, or elsewhere in Central America, and was supplemented by the Dallas-Clarendon treaty, Oct. 17, 1856.

Cleanthes, ab. 300–ab. 220 B. C. Stoic philosopher; pupil and successor of Zeno at Athens; author of a hymn to Zeus.

Clearance. Short space at the end of a pump cylinder or the cylinder of a steam engine not traversed by the piston; called the untraversed space.

Clearchus. Spartan general, who joined Cyrus with a force of Greek mercenaries 401; put to death by Tissaphernes.

Clearing House. Association of banks whose representatives meet daily, or at other stated times, to exchange checks and other evidences of their respective indebtedness, and to pay the balance due from debtor to creditor members. Each representative brings checks, drafts, and other obligations issued by other banks, and called exchanges; these are distributed, each bank in turn receiving from all the others the exchanges they have received, drawn on it, and which it must pay. The exchanges that a bank takes to the Clearing House are called creditor exchanges; those received from the other banks are debtor exchanges. If the former exceed the latter, it is a creditor bank, and a balance is due to it. If the amount of obligations drawn on it exceed the amount of exchanges it holds against other banks, it is a debtor bank and must pay the balance. These balances are paid to the Clearing House, which pays them at once to the creditor banks. At the end of a day's business, therefore, a Clearing House has no cash. In New York the aggregate daily exchanges may amount to $90,000,000 or more, while the balances to be discharged in money may not exceed 6 millions. This arrangement, therefore, of paying checks is one of the greatest economies ever introduced for dispensing with the use of money. A similar plan has been devised for settlements in the stock market. N. Y. Clearing House, year ending Sept. 30, 1895:

	Total.	*Daily Average.*
Exchanges,	$28,264,379,126.23	$92,670,095.49
Balances,	1,896,574,349.11	6,218,276.55
	$30,160,953,475.34	$98,888,372.04

Clearweed. *Adicea pumila.* Insignificant herb of the Nettle family, native of N. America; also called Richweed.

Cleat. Direction, and surface, of easiest cleavage in a seam of coal.

Cleavage. 1. In minerals, tendency to split readily parallel to faces of crystalline forms; result of molecular arrangement in crystallization. 2. In rocks, tendency to split along certain planes; result of mechanical pressure. Slates illustrate the latter.

Cleavage of Mesoblast. Separation of the mesoblast in embryos into two layers, the cleft between them being the body cavity.

Cleaveland, Parker, LL.D., 1780–1858. Prof. at Bowdoin College from 1805. *Mineralogy and Geology*, 1816.

Cleavelandite. Variety of albite, found at Chesterfield, Mass.

Cleavers. *Galium aparine.* Climbing herb of the Madder family, native of the n. hemisphere; also called Goosegrass.

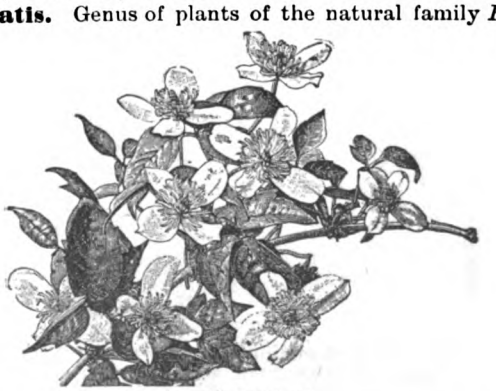
Clebsch, Rudolph Friedrich Alfred, 1833–1872. Prof. Giessen 1863; Göttingen 1868. *Lectures on Geometry.*

Cleft Palate. Congenital division of the hard or soft palate, or of both, into halves by a longitudinal fissure, which prevents the soft palate from shutting off the mouth from the nose, thus interfering with sucking (in infants), mastication, and swallowing, and altering the tone of the voice.

Cleistocarps. Sporocarps which are entirely closed, as in certain Fungi of the sub-class *Ascomycetes*, and the sporanges of a group of minute mosses.

Cleistogamy. Production by plants of inconspicuous flowers which always remain closed, in addition to the ordinary blossoms, as in many violets.

Clematis. Genus of plants of the natural family *Ranunculaceæ*, bearing showy flowers and fruit. A number of species are cultivated for ornament.



Clematis montana.

Clémenceau, Eugene, b. 1841. French Radical, prominent in the Assembly from 1871.

Clemens Alexandrinus (Titus Flavius Clemens), ab. 150–ab.215. Disciple of Pantænus and teacher of Origen; head of the catechetical school at Alexandria till 201, when he fled from persecution; one of the most eminent Greek Fathers, and the first to bring Greek culture to bear on the exposition of Christian doctrine. *Pedagogus; Stromata.*

Clemens, Samuel Langhorne ("Mark Twain"), b. 1835. American humorist and novelist. *Innocents Abroad*, 1869; *Roughing It*, 1872; *Gilded Age* (with C. D. Warner), 1873; *Tom Sawyer*, 1877; *A Tramp Abroad*, 1880; *Prince and Pauper*, 1882; *Life on the Mississippi*, 1883; *Huckleberry Finn*, 1885; *A Yankee at King Arthur's Court*, 1890; *Pudd'nhead Wilson*, 1894.

Clementi, Muzio, 1752–1832. Italian composer, founder of the modern school of pianoforte playing. His greatest work is the invaluable collection of studies, *Gradus ad Parnassum*, 1817.

Clementines. Curious heretical writings of 2d century, representing a determined attempt to force Essene Judaism upon the Church. They purported to speak, through Clement of Rome, by authority of St. Peter and still more of St. James, who is represented as Supreme Bishop. There are three: *Homilies*, *Recognitions*, and *Epitome.*—Name of part of the Canon law, ascribed to Clement V., 1305–14.

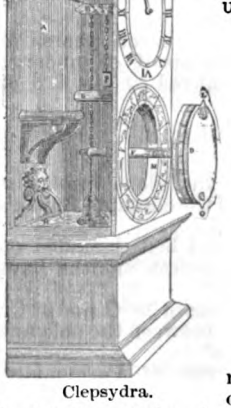
Clement of Rome. Fourth Roman bishop, author of an Epistle to the Corinthians (see Apostolic Fathers).—Clement II. Suidger, Bp. of Bamberg, pope 1046–47.—III. Paolo Scolari, 1187–91; he urged the Third Crusade, and severed the Scottish Ch. from that of England. (Also, an antipope, d. 1100.)—IV. Guido Foulques, French, pope 1165–68.—V. Bertrand d'Agoust, Bp. of Bordeaux, pope 1305–14. He began the schism of Avignon, suppressed the Templars, and assumed the triple crown.—VI. Pierre Roger, pope 1342–52 at Avignon.—VII. (Robert of Genesa, Bp. of Cambrai, antipope 1378–94.) Giulio de Medici, 1478–1534, Abp. of Florence; pope 1523–34. Involved in the quarrels of Francis I. and Charles V., and passing from one alliance to the other; he was a prisoner after the sack of Rome 1527, alienated Germany by refusing to call a Council, and to please the emperor lost England by not granting a divorce to Henry VIII.—VIII. Ippolito Aldobrandini, 1592–1605. He opposed Spanish aggression, received Henry IV. of France into the Ch., and committed Giordano Bruno to the flames. (Egidio Munoz, Spanish antipope 1424–29.)—IX. Giulio Rospigliosi, 1667–69.—X. Emilio Altieri, 1670–76.—XI. Giovanni Francesco Albani, 1649–1721, pope 1700. He favored the Jesuits, and issued the bull *Unigenitus*, 1713.—XII. Lorenzo Corsini, 1652–1740; pope 1730. He condemned the Freemasons.—XIII. Carlo Rezzonico, 1693–1769; pope 1758. He supported the Jesuits and was obnoxious to France and Spain.—XIV. Giovanni Vincenzo Antonio Ganganelli, 1705–1774, pope 1769. A man of high qualities, striving for peace, he was forced at last to suppress the Jesuits 1773.

Cleon, d. 422 B. C. Athenian politician, head of the anti-peace party from 428 B.C.; satirized in the *Knights* of Aristophanes; defeated and slain at Amphipolis.

Cleopatra, 69–30 B.C. Daughter of Ptolemy Auletes; heir with her brother to Egypt 51; deprived of the throne, but replaced 48 by Cæsar, whom she followed to Rome; Antony's mistress from 41, and the cause of his ruin at the battle of Actium. She committed suicide either by the bite of an asp or a poisoned comb.

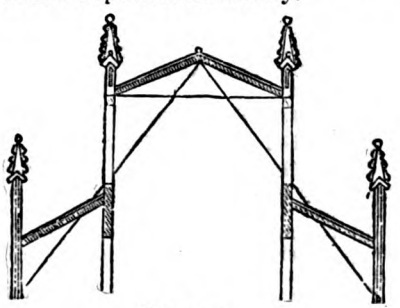
Cleopatra's Needles. Two obelisks transported from Alexandria to London and New York, 1878–80. See Obelisk.

Clepsine. See Rhyncobdellidæ.



Clepsydra.

Clepsydra. Ancient instrument for measuring time, somewhat on the principle of the hour-glass, water being employed instead of sand, in use 600 B. C., introduced at Rome 158 B. C., and still used in Europe in 17th century.



Clerestory.

Clerestory. In Gothic architecture, nave above the roofs of the aisles, so called from the windows which light the interior of the church, in contradistinction to blind-story.

Clergy. Governing and teaching body of the Church, sometimes sharply, sometimes scarcely, distinguished from the laity.

Clergy, BENEFIT OF. See BENEFIT OF CLERGY.

Clergyman's Sorethroat. Chronic disease of the throat common in those who are accustomed to speaking in public; caused by a granular condition of the mucous membrane, and marked by hoarseness and the secretion of mucus.

Clermont-Ferrand. Ancient city of France. at the base of the Puy-de-Dôme, formerly capital of Auvergne. Its bishopric dates from 253. The Council which decreed the First Crusade was held here 1095. Pop., 1891, 45,083.

Cleveland. City of Cuyahoga co., Ohio, on the shore of Lake Erie, at the mouth of Cuyahoga R. It has 7 railroads and a considerable lake commerce. It covers 32 sq. m. and is supplied with water by pumping from Lake Erie. It has large manufactures, especially of iron and steel. It was founded 1796, chartered as a village 1814, as a city 1836, and enlarged by annexing suburbs 1872–93. Pop., 1890, 261,352, since much increased.

Cleveland, GROVER, b. 1837. Twenty-second Pres. of the U. S. He first won public recognition as Mayor of Buffalo, N. Y., 1881, where he so administered municipal affairs in the interests of reform that he was elected by the Democratic party Gov. of N. Y. 1882. In 1884, by the influence of the reform element, he was nominated for the presidency in opposition to Blaine, and elected. A courageous stand in behalf of a reduction of the tariff, in the interests of legislative reform and economy, together with an honest effort toward the reform of the civil service, thwarted in many localities by the office-seeking element, were the chief features of his administration. He was a candidate for re-election in 1888, but was defeated by Gen. Harrison. In 1892 he was again nominated against Harrison, and received 276 out of 444 electoral votes, carrying 23 States.

Cleveland, JOHN, 1613–1659. English royalist and satirical poet, once highly esteemed. He wrote *The Rebell Scot* and the *Hue and Cry after Sir John Presbyter.*

Cleveland Bay. See HORSE.

Cleves. Prussian town; seat of Counts in 11th century; capital of a duchy 1417; united to Brandenburg 1614; ceded to France 1805; restored to Prussia 1815. Pop., 1890, 10,409.

Clevis. U-shaped piece of iron, having holes in the ends, through which a pin or bolt can be placed; used in plows, etc., also in the connections of the lateral bracing in some iron bridges.

Clew-Lines. Ropes which come down from the yards to the lower corners of the sails, by which the lower corners or clews of the sails are hauled up.

Cliff Brake. Ferns of the genus *Pellæa,* plants of wide geographical distribution.

Cliff Dwellers. Pueblo Indians, who once lived in the canyons, especially of the San Juan R. of s.e. Utah, related to the Zuni or the Moqui. They cultivated the arable land at the bottom of the canyon and dwelt in pueblo-like houses built on ledges and in caves, both natural and artificial, high up the canyon wall. One series of ruins extends continuously for 25 m.

Clifford, NATHAN, LL.D., 1803–1881. Atty.-gen. of Me. 1834–38; M.C. 1839–43; U. S. Atty.-gen. 1846–48; Justice of U. S. Supreme Court from 1858.

Clifford, WILLIAM KINGDON, 1845–1879. English mathematician; prof. Univ. Coll., London, 1871. *Biquaternions; Classification of Loci; Theory of Graphs,* 1881; *Dynamics,* 1878–87; *Seeing and Thinking,* 1879; *Lectures and Essays,* 1879; *Common Sense of the Exact Sciences,* 1885.—His widow, LUCY (LANE), has won repute as a novelist. *Love Letters of a Worldly Woman,* 1889; *A Flash of Summer,* 1894.

Climacteric. Period recurring every seven years, at which the system was supposed to renew itself or undergo marked changes. Grand Climacteric occurred at the 63d or 81st years.

Climate. See CLIMATIC ZONES.

Climath. See IVY, POISON.

Climatic Zones. System dividing the globe into belts according to the characteristic features of the climate. Supan's zones are three:

(*a*) Warm or torrid zone, or the Tropical belt, bounded on the polar sides by the regions where the coldest months have a temperature of 20° C. (68° F.);

(*b*) Temperate zones, between the isotherms of 20° C. and 0° C.;

(*c*) Cold, or Arctic and Antarctic zones, between the pole and the isotherms of 0° for the coldest month.

The Greeks generally adopted the zones of Parmenides. Ptolemy, 150 A.D., Al Istakhri, 950, and Paul Heylyn, 1626, adopted climatic zones such that the average difference in the length of the day is half an hour per zone. Hann adopts Supan's classification with slight change. Koppen lays special stress upon those zones between which the mean temperature is above 10° C. (50° F.) for 1 and 4 months respectively. Therefore his zones depend upon duration as well as intensity of temperature.

Wojeikoff distinguishes the zones according to the quantity and character of the rainfall:

(*a*) Zone of ocean trades, with very rare rainfalls.
(*b*) Region of equatorial rains, including the zone of calms.
(*c*) Region of rain prevailing throughout the year.
(*d*) Sub-tropical zone, with rainless summers.
(*e*) Zone of the fall and winter rains of middle latitudes.
(*f*) Zone of summer rainfall of middle latitudes.
(*g*) Zone of equal distribution of rain throughout all seasons.
(*h*) Polar region, with light snows in winter.
(*i*) Deserts and semi-deserts, with an annual precipitation less than 250 mm. (10 in.).
(*k*) Regions of the Australian monsoons.
(*l*) Regions of the Asiatic monsoons.
(*m*) Regions of the African monsoons.

Supan's classification, based on the study of Isotalantosan, is—

(*a*) Marine and equatorial climates whose temperature variations are less than 15° C.

(*b*) Transition climate, variations greater than 15° C. and less than 20° C.

(*c*) Land climate, variations greater than 20° C. and less than 40° C.

(*d*) Extreme continental climate, variations greater than 40° C.

Climbing Perch. See ANABAS.

Climbing Stems. Those which attach themselves to some fixed support in various ways, and by its aid rise in the air.

Clime. Space of earth comprehended between two parallels, or small circles so far asunder that the difference in the lengths of the days is a half hour. This special use of the word is now obsolete.

Clinandrium. Central portion of an orchid flower, consisting of an adnate anther and stigma.

Clinanthium. Receptacle of the anthodium of *Compositæ;* also known as Phoranthium and Cœnanthium.

Clinch, CHARLES POWELL, 1797–1880. American poet and journalist.

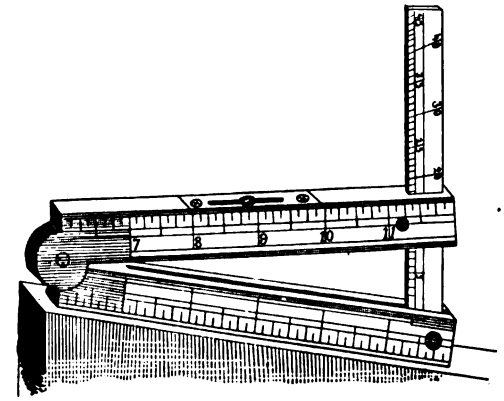
Clingman, THOMAS LANIER, b. 1812. M. C. 1843–47 and 1849–58; U. S. Senator from N. C. 1858–61; mineralogist.

Clinidium. In Lichenology, stalk which bears a stylospore.

Clinkstone, or PHONOLITE. Siliceous rock of igneous origin, that gives a clear ringing sound when struck with a hammer.

Clinochlore. $Mg_5Al_2Si_3O_{14}+4aq$. Variety of chlorite, crystallizing in the monoclinic system.

Clinometer. Instrument for measuring the angle of dip of strata. It consists of a small pendulum hanging in front of a graduated circle, and when set on edge on the surface of a



Clinometer.

rock marks the angle of inclination. As used by engineers in measuring slopes, it consists of a bubble for determining a level and a graduated limb for reading the angle of slope. One of the simplest forms, and perhaps the best for common work, is shown in the figure.

Clinostat. Apparatus for causing a plant to revolve in a horizontal position at a uniform rate of speed.

Clinton. Limestone in the Silurian series of N. America,

immediately overlying the Medina Sandstone. In these beds in Pa. occur the remains of the oldest American vertebrates. See SILURIAN and PALÆASPIS.

Clinton. City of Clinton co., Ia., on w. bank of the Mississippi. Pop., 1890, 13,619.

Clinton, DE WITT, 1769–1828. U. S. Senator 1802; Mayor of New York 1803–7, 1809–10, 1811–15; presidential candidate 1812; Gov. of N. Y. 1817–22 and from 1825. The Erie Canal was surveyed 1809, and completed 1825, mainly through his efforts.—His father, JAMES, 1736–1812, was a general in the War of Independence; his uncle, GEORGE, 1739–1812, was Gov. of N. Y. 1777–95 and 1801–3, and Vice-Pres. from 1804. His was the first idea of the canal.

Clinton, SIR HENRY, 1738–1795. British general in the Revolutionary War. He succeeded Sir Wm. Howe as Commander-in-Chief 1778, and was made Gov. of Gibraltar 1793.

Clinton, HENRY FYNES, 1781–1852. M. P. 1806–26. His *Fasti Hellenici*, 1824–34, and *Fasti Romani*, 1845–50, are of high value in chronology. *Remains*, 3 vols., 1854.

Clio. Muse of history and epic poetry.

Clione. See MONACTINELLIDÆ.

Clipper. Fast-sailing merchantman, attention being directed to the ship's lines to combine the highest speed with the greatest freight capacity. With favorable winds English and American clippers have frequently averaged 15 m. per hour for long distances.

Clistenterata. See TESTICARDINES.

Clisthenes, or CLEISTHENES. Athenian statesman, active in and after the banishment of Hippias 510 B. C.

Clitellum. Swollen part of the body of a leech near the 24th ring, filled with ripe reproductive cells at the breeding season.

Clitellus. "Girdle" of the earthworm; enlarged band of thickened hypodermis at the 29th segment, serving as a clasping organ. Later it secretes the cocoon or egg case.

Clitoris. Small mass of erectile tissue in the middle line of the vulva, just above the opening of the urethra.

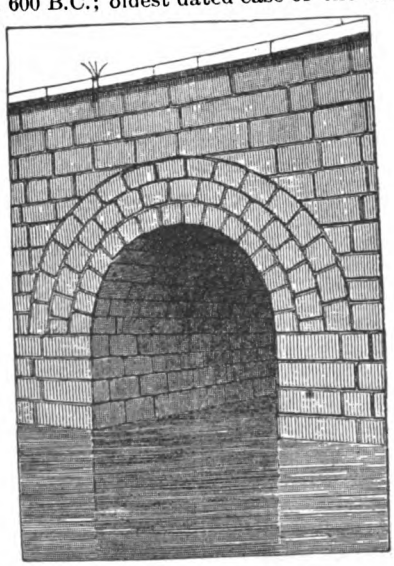
Clive, MRS. CAROLINE (MEYSEY-WIGLEY), 1801–1873. English novelist and poet. *Paul Ferroll*, 1855.

Clive, MRS. KITTY (RAFTOR), 1711–1785. English actress, well known and liked till 1769.

Clive, ROBERT, LORD, 1725–1774. Founder of English rule in India. He went out 1743; entered the army 1747; took Calcutta 1757, and defeated Surajah Dowlah at Plassey; was Gov. of Bengal 1757–60; Baron 1762, and Gov.-gen. of India 1764–67; was accused of extortion 1773, but acquitted; died by his own hand in London.

Cloaca. Common chamber into which the rectum and the urinary and genital ducts open, in the lower mammals and inferior vertebrates.

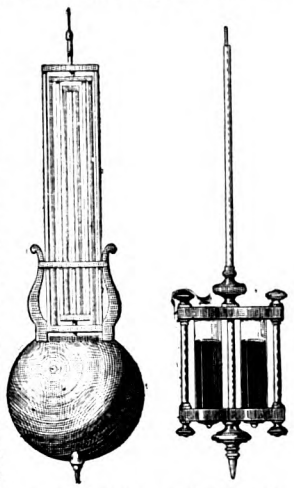
Cloaca Maxima. Sewer at Rome constructed for the Tarquinii ab. 600 B.C.; oldest dated case of the arch in Italy,



Cloaca Maxima (Restored).

undoubtedly Etruscan. The archway by which it discharged its waters into the Tiber still exists, 11 ft. wide by 12 high, and the sewer may be traced for over 1,000 ft. It was flushed by the overflow from the aqueducts.

Clock-Pendulum, or COMPENSATION PENDULUM. Constructed so as to compensate for the effect of changes of temperature. A common form was invented by Harrison, and from its shape is called the gridiron pendulum. The suspending part consists of an odd number of rods of two kinds of metal; *e.g.*, five, three iron and two brass. These rods are so arranged that the downward expansion of the iron bars is equal to the upward expansion of the brass. The lengths of the two sets must be inversely as their co-efficients of expansion, and thus the radius of oscillation will remain constant and the time of the pendulum will not be affected by any temperature changes. Another, invented by Graham, is called the mercury pendulum. The bob is a glass cylinder partly filled with mercury; the expansion of the rod downward is compensated by the upward expansion of the mercury. Mercury being more expansible than the material of the rod, the cylinder need not be of undue length. It may be effected by the differential expansion of a cross-bar attached to the rod near the bob; a rise of temperature causes the bar to bend its arms upward, thus tending to raise the center of oscillation, and a fall of temperature produces the inverse effect.



Clock-Pendulum, or Compensation Pendulum.

Clocks. See CLEPSYDRA. Clocks were moved by weights ab. 750. A tower-clock was placed in Canterbury Cathedral 1292; a pendulum clock was made in Cordova, Spain, ab. 1000. For astronomical purposes clocks are regulated to show either mean solar, or sidereal time, more commonly the latter. The clock shows 0h. 0m. 0s. at the instant when the vernal equinox crosses the meridian, and in consequence of the earth's motion in its orbit the sidereal day is 3m. 56.555s. shorter than the mean solar day.

Clockwise. Positive direction of rotation of a solid or a fluid. If we stand in the n. hemisphere facing the n. pole, daily rotation of the sun is from the e. through the meridian toward the w., or from our right hand to our left; consequently the earth rotates in the opposite direction, or from left to right. European and American clocks and watches are so made that if we hold the face of one toward us as we face the n. the hands rotate like the earth toward the right. If then, in general, we look at the face of a clock or watch, its hands are moving "clockwise," or "positive," or "with the earth."

Clod. Soft shale or slate, making an unsafe roof, especially in coal mines.

Clodius, or CLAUDIUS, d. 52 B.C. Roman demagogue, tried for profaning the mysteries of Bona Dea 62 B.C.; tribune of the plebs 58; enemy of Cicero, whose banishment he procured; slain in an affray with Milo.

Cloissonée. See ENAMEL.

Cloister. Inclosed place; passage adjoining a building, sheltered by a separate roof, carried upon an outer wall pierced with open arches.

Cloistered Arch. Dome formed by two intersecting circular arches, the portions without the groins being removed, so that the structure is in a sense the complement of the groined arch.

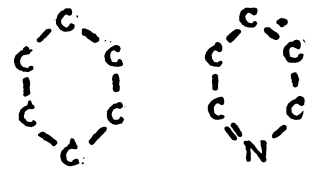
Clontarf. Irish town, near Dublin. Here Brian Boroihme, King of Munster, defeated the Danes, April 23, 1014. Pop. ab. 4,200.

Clootz, JEAN BAPTISTE DU VAL DE GRACE, BARON, 1755–1794. Enthusiast, self-styled "Anacharsis"; b. near Cleves, resident in Paris. He spent, wrote, and talked much for the Revolution, and died by the guillotine.

Close. Inclosure of a cathedral or abbey-church.

Close Column. Formation of troops in column, when the subdivisions are nearer together than the front of one subdivision. In the school of the battalion the distance between companies is eight paces. Whenever a subdivision takes its place, the file closers close to one pace from the rear rank, falling back to two paces whenever the full distance is again taken.

Closed Chains. Atoms united with each other so that the nucleus of the molecule is of ring form, as



Closed Curve. One which from any point returns into itself.

Closed Work. Field fortification subject to attack on all sides, therefore an isolated work not commanded from the rear. When it can be thus commanded, its gorge may be closed by a defensive stockade, to prevent its capture by a rush around its flanks.

Close Hauled. Position of a ship's sails when she endeavors to make progress in the nearest direction possible toward that point of the compass from which the wind blows.

Clostridium. Large single spore in a bacterium, which bulges out the walls of the cell.

Closure, or CLOTURE. Procedure for closing a debate, adopted in the House of Commons 1882. It corresponds to "moving the previous question" in the U. S.

Clotbur. See COCKLEBUR.

Clothaire I., 497–561. King of the Franks 558; son of Clovis.—II. King 615–28, son of Chilperic I.

Clothes Moth. See MICROLEPIDOPTERA.

Clotho. One of the Fates, who held the spindle.

Clotilda, ST., 475–545. Queen of CLOVIS (q.v.), and instrumental in his conversion and that of France.

Cloudberry. *Rubus chamæmorus.* Low plant of the Bramble genus, native of the colder parts of the n. hemisphere.

Cloud Bursts. Violent rains, usually very local, and destructive in narrow spaces.

Cloud Engine. Engine of Wm. Mount Storms. Air was admitted to the cylinder with the steam and expanded by its heat. Claims of great saving were made, but the only real advantage to offset the complication was that the air in mixture with the steam prevented cylinder condensation to some extent, and when the engine cannot be run condensing a small gain might be hoped for. See AERO-STEAM ENGINE. Other inventors have injected the chimney gases into the steam, by which some of the usual losses are avoided, and what gain there is comes from this and from obtaining a higher temperature with a same pressure.

Cloud Projector. Apparatus devised by Stokes 1883, by which, from two photographs of a cloud taken by twin cameras at a distance, one deduces mechanically the altitude and dimensions of its parts.

Cloud Ring. Belt or ring of perennial cloudy sky and moist calm air that surrounds the earth at the Meteorological Equator.

Clouds. Forms assumed by the condensed moisture of the atmosphere when condensed into innumerable globules of water or crystals of ice. The study of the clouds is one of the most important departments of meteorology. The appearances, the heights, and, to a certain extent, the physical structure is made the basis of the system of nomenclature recommended by the International Meteorological Committee in August, 1894.

(A) Highest clouds. 1. Cirrus; 2. Cirro-stratus. Mean altitude 9,000 meters.

(B) Intermediate clouds. 3. Cirro-cumulus; 4. Alto-cumulus; 5. Alto-stratus. Mean altitude 3,000 to 8,000 meters.

(C) Low clouds. 6. Strato-cumulus; 7. Nimbus. Below 2,000 meters.

(D) Clouds formed by diurnal ascending currents. 8. Cumulus, base ab. 1,400 and summit ab. 1,800 meters; 9. Cumulo-nimbus, base 1,400 and apex from 3,000 to 8,000 meters.

(E) Elevated fog. Altitude less than 1,000 meters. 10. Stratus.

These ten types of clouds are described as follows—

1. Cirrus. Isolated feathery clouds of fine fibrous texture.
2. Cirro-stratus. Fine whitish veil.
3. Cirro-cumulus. Fleecy cloud. Small white balls, and wisps without shadows, or with very faint shadows, which are arranged in groups and often in rows.
4. Alto-cumulus. Dense fleecy cloud. Larger whitish or grayish balls with shaded portions, grouped in flocks or rows, frequently so close together that their edges meet.
5. Alto-stratus. Thick veil of a gray or bluish color.
6. Strato-cumulus. Large balls or rolls of dark cloud which frequently cover the whole sky, especially in winter.
7. Nimbus. Rain clouds. Dense masses of dark formless clouds with ragged edges.
8. Cumulus. Woolpack clouds. Thick clouds whose summits are domes with protuberances but whose bases are flat.
9. Cumulus-nimbus. Thunder cloud, shower cloud. Heavy masses of clouds, rising like mountains, towers or anvils, surrounded at the top by a veil or screen of fibrous texture ("false cirrus") and below by nimbus-like masses of cloud.
10. Stratus. Lifted fog in a horizontal stratum.

Cloud Theodolite. Single form of Alt-azimuth instrument by which to make observations on the directions of clouds, aurora, haloes, or other large or indefinite meteorological appearances: the essential peculiarity is the use of a conical sight-tube instead of a telescope, and the introduction of a cross-bar with position-circle at the distance of distinct vision for the unaided eye.

Clouet, JEAN, 1485–1545. Painter and Valet de Chambre to Francis I. of France, whose portrait in the Louvre is ascribed to him.—His son FRANCIS, ab. 1510–1580, succeeded him as court painter.

Clough, ARTHUR HUGH, 1819–1861. English poet of the subtle and introspective order, strongly marked by the spirit of his time, and highly prized by a select audience; commemorated by Matthew Arnold in *Thyrsis. The Bothie of Tober-na-Vuolich,* 1848; *Ambarvalia,* 1849; *Amours de Voyage,* 1858; *Dipsychus; Mari Magno.* His writings were collected 1862–69. —His sister, ANNE JEMIMA, 1822–1892, was founder, 1875, and head of Newnham Hall, Cambridge.

Clove Pink. *Dianthus caryophyllus.* Herbaceous plant of the natural family *Caryophyllaceæ,* native of Europe, widely cultivated as a garden flower in a variety of forms under the name Carnation.

Clover. Plants of the genus *Trifolium,* natural family *Leguminosæ,* of wide geographical distribution; known also as Trefoil; next to the grasses the most important forage plants of the U. S. Other closely related plants are ALFALFA, LESPEDEZA, and SAINFOIN (q.v.). Three or four species of clover are in general cultivation throughout the n. portion of the U. S. Red Clover (*T. pratense*), the largest and most important, is a biennial, and is valuable for both pasture and hay;

A, White Clover (*Trifolium repens*).
B, Red Clover (*Trifolium pratense*).

two varieties are known, medium and mammoth or pea-vine clover. Alsike Clover (*T. hybridum*), supposed to be a hybrid between red and white clover, is of medium size, and is also used for both pasture and hay; it will thrive on poorer land than red clover. White Clover (*T. repens*) is a perennial of low creeping habit, and mainly valuable for pasture. Alsike Clover and White Clover are important honey-producing plants. Crimson Clover (*T. incarnatum*), an annual, has been recently introduced in the Southern-Middle States.

Clover, PRAIRIE. Herbs of the genus *Kuhnistera,* natural family *Leguminosæ,* natives of w. N. America.

Clover, SWEET. Herbs of the genus *Melilotus,* natural family *Leguminosæ,* natives of the Old World, introduced into America. The foliage is odorous in drying.

Cloves. Dried, unexpanded flower-buds of *Eugenia caryophyllata,* a tree of the Myrtle family, native of the E. Indies, and widely cultivated.

Clovis, or CHLODWIG, 465–511. King of the Franks 481; Merovingian. He defeated the Romans near Soissons 486, and

the Visigoths near Poitiers 507. His marriage to Clotilda, 493, led to the connection of France with Rome.

Clown. See JESTER.

Clubfoot. Deformity of foot, in which it may rest on the inner or outer sides, the heel or toes be raised, the foot flattened, or the arch of the instep too high, or a combination of any of these; relievable by operation or specially constructed shoes.

Club Law. Compulsion through fear of chastisement.

Club Mosses. Plants of the order *Lycopodiaceæ* or Lycopods.

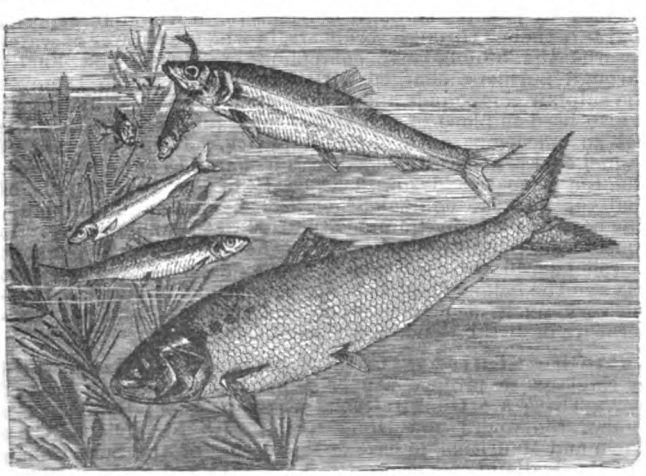
Club Rush. See BULRUSH.

Clubs. Associations with political, literary, or social aims. The Lacedemonians formed parties of fifteen, each contributing wine or food. The oldest member stood at the door to assure the others that nothing spoken within doors would be repeated outside. They balloted for admission by throwing into a basin soft balls of bread which had first to be pressed flat; left round they counted as black-balls. The first social clubs in England were the convivial meetings of Shakespeare, Raleigh, Ben Jonson and other great Elizabethans at the famous Mermaid and Devil taverns. Under the Commonwealth and later Stuarts these were supplanted by the coffee-houses. The Rota, a political club, was started 1659 at Miles' coffee-house, and White's 1698 at White's coffee-house, while Burton's was frequented by Addison, Steele, and the wits of Queen Anne's days. Eating, drinking, and gambling were found an efficacious antidote to plotting and turbulence, although the Roaring Boys avowedly organized the Molochs, Blasphemous, Mums, Hectors, Sorcerers, and Nickers, for drunken orgies and street ruffianism, which called forth a Royal Proclamation in 1712. The Civil Club, literary and commercial, founded 1669, still exists. Other famous clubs were Kit-Cat, literary and political, 1700; Dilettanti, fine arts, 1734; Beef Steak, fashionably bohemian, 1735; Royal Society, scientific, ab. 1743; Boodle's 1762; Literary (Dr. Johnson's) 1764; Royal Naval 1765; Arthur's 1765; Almack's (afterward Brooke's), Whig, 1765. French clubs were essentially political and arose ab. 1782. The most celebrated and powerful were the Club des Jacobins and the Club des Cordeliers; they disappeared with the Directory in 1799. Resuscitated by the revolutionary movements of 1848 they were suppressed in 1849 and 1850. Paris has many social clubs on the English model. Social and literary clubs are found in every large town of the U. S. The first was the Union Club of N. Y., founded 1836; Century Association 1847; Union League 1863; University 1865; Manhattan 1865; Authors' 1882 and Players' 1888, all of New York. Philadelphia has the Philadelphia, Union League and the Rittenhouse 1875; Baltimore, the Maryland 1857 and the Baltimore; Washington, the Metropolitan 1884, Army and Navy and the Cosmos 1878; Chicago, the Union 1878, the Union League 1879 and Chicago 1869; Boston has Somerset 1851, the Algonquin 1886, and St. Botolph.

Clugni, or CLUNY. Benedictine abbey in e. France; founded 910; long powerful; sacked by Huguenots 1562; suppressed 1793.

Cluny, HOTEL DE. At Paris; founded 1833. It contains a fine collection of Roman and Mediæval antiquities. The building dates from the 15th century, and is erected over the ruins of a Roman bath.

Clupeidæ. Herring family, isospondylous fishes, characterized by an elongate, compressed body, covered with cycloid



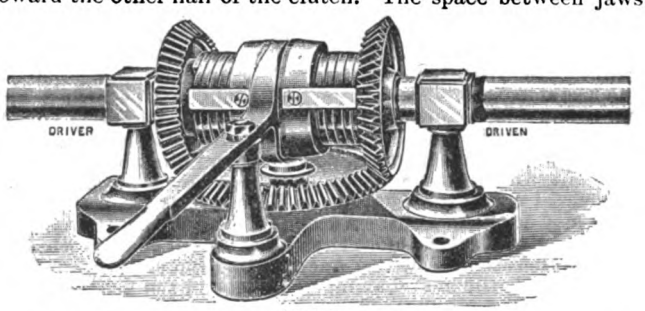
Clupeidæ.

scales, the head naked, mouth large, teeth feeble, no lateral line, nor adipose fin. Here are included 130 species, among them the common herring (*Clupea harengus*); the Alewife (*C. vernalis*), which ascends rivers with the shad, from which it differs in smaller size and shorter gill rakers; the Menhaden or Mossbunker (*Brevoortia tyrannus*), of which enormous quantities are caught, the oil extracted and the refuse used for fertilizer stock. The Menhaden run in schools and are taken in large boats especially engaged in this business. *Clupea sapidissima* is the anadromous Shad, of which great numbers are taken every spring in the Atlantic coast rivers. It has also been successfully introduced on the Pacific coast. *C. pilchardus* is the true Sardine.

Clusius, CAROLUS, 1525–1609. French naturalist. *Exoticorum libri decem*, 1605.

Clustered Pier. In Mediæval architecture, a pier or pillar formed by an assemblage of shafts, often interspersed with square arrises, and properly corresponding to divisions of the supported mass.

Clutch. In transmissive machinery, a device for engaging and disengaging a machine from the source of motive power. Three kinds are used. First, pin clutches, where one disk turned by the driving power faces a second one connected to the machine to be driven. The one has projecting pins on the face, and the other corresponding holes. By moving one half along the common axis, the pins catch in the holes and the two halves turn as one. This type is applicable for light work only. A second class embraces jaw clutches, where the pins become sectors projecting from the face of one half, and the holes are depressed sectors in the face of the other. These are applicable for the heaviest classes of work as well as lighter, but start motion with a shock. To make such clutches easier to engage, the projecting jaws are sometimes made so that their section will appear as a rightangled triangle, with the hypothenuse toward the other half of the clutch. The space between jaws



Clutch.

equals the base of the triangle, and the sharp apex enters the space easily, but they come together solidly when engaged completely. The third class is friction clutches. An exterior cone forms one half, and a hollow cone the other; the two are pressed together, and frictional pressure prevents slip; or, the one half is a hollow cylinder, and on the other part sectors are forced out radially till they press upon the hollow cylinder; or, grooves of a V-section are turned in the two faces, and the hollows of one fit over the ridges of the other; or a rib or ring on the one half is seized on both sides by pads which are borne by the second half; and there are many other types of detail. The advantage of the friction clutch is that it starts the driven machinery gradually, and hence without shock. By making the driving surface of wood, and the driven of iron, unequal wear is retarded, and the wood contact is cheaply renewed. In fluid transmissions the gradual action of the friction clutch is paralleled by the slow opening of the engaging valve.

Clyde. River of w. Scotland, 75 m. long.

Clydesdale. See HORSE.

Clymer, GEORGE, 1739–1813. Of Pa.; signer of the Declaration of Independence.

Clypeastroidea, or CLYPEASTRIDEA. Irregular sea-urchins with the mouth central, in position, on the lower side of the disk, and furnished with teeth. The anus is eccentric in position. The ambulacral areas constitute a five-leaved rosette at the apical pole, and there are five genital pores surrounding the madreporite. Popularly known as "shield urchins."

Clypeus. Front of the head in insects. It carries the labrum below, and its top end is often present as a separate piece, the supra-clypeus.

Clytemnestra. Wife of Agamemnon, whom she slew on his return from Troy to Mycenæ; slain by her son Orestes.

Clytia, or CLYTIE. Nymph, beloved by Apollo; turned into the Heliotrope.

Cnidæ. Nettle-cells.

Cnidaria (NEMATOPHORA, or CŒLENTERATA). *Hydrome-*

dusæ, coral zoöphytes (*Actinozoa*), and *Ctenophora; i.e.*, animals furnished with cnidæ.

Cnidoblast. Cell in which a nematocyst develops.

Cnidocil. Hair-like process on a cnidoblast, the irritation of which explodes the inclosed nematocyst.

Cnidus. Ancient city of Caria, near which the Athenian fleet, under Conon, defeated the Lacedemonians 394 B.C.

Coaches. The credit of the invention is claimed by France, Italy, Hungary and England. The first was made in England in 1555, and after the League they appeared in Paris. The vile condition of the roads and the clumsiness of these springless vehicles retarded the popularity of coaching for another century. Under Louis XIV. the body was suspended by straps, and during the 18th century these straps were attached to C-springs as at present. After these improvements town-coaches had still to overcome the opposition of watermen and sedan-bearers. The first stage-coach in England was from London to Coventry in 1659.

Coadjutor. Assistant of a diocesan bishop, commonly with right of succession.

Coagulation. Property of solidifying possessed by several animal fluids, when exposed outside their proper channels or when chemically affected; as coagulation of blood on exposure to the air, of egg albumen on boiling, or milk on treatment with an acid.

Coal. The great mineral fuel of the world, consisting of the remains of extinct, chiefly cryptogamic plants, often of large size. See SIGILLARIA, LEPIDODENDRON, CALAMITES. The remains of these and of many other plants have been massed together, covered up and compressed; much of their volatile matter has escaped, and the residue forms our now existing coal-measures. Some of these have evidently been formed where the plants grew, but in other cases the material seems to have been drifted together. Fireclay, containing roots, is the usual base of a coal-seam, and shale, often crowded with plant remains, frequently forms the roof. Coal-seams vary in size from the Mammoth Vein of e. Pa., which is in some places 50 ft. and more in thickness, down to mere films of coaly matter. In America at present few beds less than 30 in. are considered worth working, but in Europe beds 12 in. thick and even less are taken out. An acre of coal in the ground, 3 ft. thick, contains rather more than 5,000 tons of coal, of which in most collieries in America one-third to one-half has usually been mined, the rest having been left in the ground or destroyed in the mining. Greater economy is now being introduced and a higher percentage of coal saved in the better class of collieries, but the waste is still enormous. This waste is largely increased by the loss in its employment as fuel. The best steam engines utilize only about one-tenth or one-eighth of the energy of the coal. A pound of coal is capable of evaporating 15 lbs. of boiling water, but in practice more than 9 lbs. of steam is seldom obtained. The rapidly diminishing store of fuel has in some countries drawn attention to this waste, and great and successful efforts are being made to reduce it.

The chief coal-fields of N. America are: 1. The anthracite fields of e. Pa. 2. The bituminous coal-fields of w. Pa., O., W. Va., Ky., Tenn., etc., to Ala. 3. The bituminous coal-fields of Ill. and Ind. 4. The bituminous coal-fields of Mo. and Ia. 5. The bituminous coal-fields of Mich. 6. The bituminous coal-fields of Nova Scotia. Of these fields the 1st and 2d are the most important for the quantity and quality of their yield. In the 3d, 4th, and 5th, the beds are thinner and the quality is inferior; in the 5th especially the coal is of comparatively little value. The 6th is fully equal to the 2d in quality, but much less in extent. At the present rate of increase in the consumption of coal there is no probability of the exhaustion of the N. American fields for many centuries, though the end of the Pa. anthracite will come much sooner and indeed is already in sight.

Coal consists largely of carbon, with some chemically combined hydrogen, oxygen and nitrogen, and varying quantities of inorganic ash. Coals are classed as lignite or brown, soft or bituminous, and hard or anthracite coal. Lignite is of a dark brown to black color, frequently shows a woody structure, burns with a feeble, yellow, smoky flame, without much heat and with a smell of tarry matter. The sp. gr. is between 1 and 1.40, and in composition the fixed carbon varies between 50 and 70 per cent, or, if the water is driven off, between 60 and 80. Large beds of lignite are found in Europe, where it is used for purposes not requiring a strong heat, as evaporating solutions, burning lime, and for domestic uses. Practical use shows that it takes 3 parts of lignite by volume to have the same heating effect as 1 part of hard coal, or 2½ parts by weight. It excels kiln-dried wood, weight for weight, in evaporating power, being able to evaporate 5 to 6 times its weight of water. It is sometimes charred, but the charcoal produced is of poor quality, being too soft.

Bituminous coals are black, compact substances showing no sign of vegetable structure. They are brittle, opaque, dull or shining, and when heated in closed vessels leave coke. They are divided into several classes, such as caking and non-caking, long flame and short flame. The caking coals become pasty when heated, swell up, give off bubbles of gas burning with a bright yellow flame, and if air is not present form a hard lump of coke. Non-caking coals are dry, and leave a powder instead of coke. Long-flame coal is particularly chosen for use in long furnaces, where the heat is to be carried a distance from the fire-place: this peculiarity is due to a large proportion of rich hydrocarbons in it. Caking coals with a long flame are suited for making illuminating gas, as they give large quantities of rich gas, and afford a good coke, which finds a ready market. Caking coals with short flame are suitable for blacksmith's use. Non-caking coal with long flame is used in reverberatory furnaces and in evaporating, also for heating large ovens to an even temperature. Non-caking coal with short flame makes a good coal for raising steam, as it does not cake and clog up the grate, neither does the flame stop up the flues of the boiler. The chemical composition of these coals varies from 75 to 90 per cent of carbon, of which 55 to 85 per cent is fixed, and remains in the coke. The sp. gr. is 1.2 to 1.4, and will evaporate 8 to 10 times their weight of water. Cannel coal is dull, compact, very rich in bituminous matter, and therefore suitable for gas making.

Anthracite or stone coal is jet black, hard, and has a sp. gr. of 1.3 to 1.75. It contains very little volatile matter, and does not produce a coke. The composition varies between 80 and 95 per cent of fixed carbon, with 5 to 15 per cent of ash. The evaporative value of these coals is high, being 9 to 12 times their weight of water. They burn with a short, blue flame, giving an intense heat, but requiring more of a body of fire to keep them ignited than the softer coals.

In England, where the most of the coal is bituminous, distinctions are based largely on prominent physical characters or adaptability to special uses. In the U. S. the custom is to classify coal (excluding lignite) as anthracite, when containing less than 6 per cent volatile matter; semi-anthracite, in which the volatile matter is more than 6 per cent and less than 10 per cent; semi-bituminous, where the volatile matter is between 10 and 18 per cent; and bituminous, if the amount of volatile matter is more than 18 per cent. The most extensive deposits of coal are found in the Carboniferous formation, though it is also abundant in rocks of Mesozoic and of Tertiary age. In 1893 the amount of coal mined in the world was about 550,000,000 tons, of which Great Britain produced about 180,000,000, the U. S. more than 160,000,000, and Germany 95,000,000. In 1882 the aggregate production was less than 400,000,000 tons, and in 1845 only 50,000,000 tons.

Coal Breaker. See BREAKER.

Coal Cars. Four-wheeled coal cars weigh ab. 7,000 lbs., and carry five or six tons. Eight-wheeled cars usually weigh ab. 30,000 lbs., and have a capacity of 60,000 lbs. The former are now going out of use.

Coalescence. Union of similar parts of a flower in the same circle, as the anthers in *Compositæ*.

Coal Gas. Illuminating gas is made by heating bituminous coal in clay or iron retorts, at a cherry-red heat, and it is purified by passing through condensers, in which it deposits coal tar, thence through scrubbers, in which a shower of water absorbs the ammoniacal compounds produced, and finally through purifiers, charged with slaked lime, which removes the sulphur compounds and carbon dioxide. Ferric hydroxide is also used in place of the slaked lime, for economy, but it is not so efficacious with either impurity. 5 to 10 per cent of cannel coal is generally added to the charge to enrich the gas. One ton of coal yields ab. 10,000 cu. ft. of gas, 10 to 15 gals. of coal tar and the equivalent of 22 lbs. ammonium sulphate. The best gas has an illuminosity of 20 to 30 candle power. It consists of a mixture of 50 per cent hydrogen, 25 per cent marsh gas, 10 per cent carbon monoxide, 8 per cent olefiant gas and the balance higher hydrocarbons and impurities, varying very much, depending upon the coal used and the temperature of distillation. See WATER GAS.

Coaling Stations. Chain of ports and harbors fortified by England to protect her principal trade-routes in case of war. These are Gibraltar, Malta, Suez, Aden, Bombay, Colombo, Singapore and Hong Kong, with St. Helena, Cape Town and Mauritius, in case of the closing of the Suez Canal. The Australian ports are fortified by the Colonies and equipped by England. The West Indian trade is protected by coaling stations in Jamaica and St. Lucia.

Coal Tar. Distillate obtained in the manufacture of

illuminating gas from bituminous coal, 10 to 15 gals. per ton of coal. By distillation it yields a mixture of hydrocarbons, the first called gas-oil, used to enrich WATER GAS (q.v.), the second, light oils, which yield upon redistillation, benzene and toluene, used for the production of anilines; and dead-oil, used as an antiseptic and from which carbolic acid is obtained. Water-gas manufacture does not yield these products to any extent.

Coal, WEIGHT OF. Pa. anthracite coal, prepared for the market, weighs from 51 to 55 lbs. per cubic foot, the larger sizes being the heavier. Bituminous coal weighs from 45 to 49 lbs.

Coan, TITUS, 1801–1882. Missionary at Hilo, Hawaii, from 1835; observer of the volcano Kilauea. *Patagonia*, 1880; *Life in Hawaii*, 1882.—His son, TITUS MUNSON, M.D., b. 1836, conducts the N. Y. Bureau of Revision.

Coarctatæ. Division of *Diptera*, including *Muscidæ*, *Œstridæ*, etc., in which the pupæ are formed within the larval skin, which hardens into the pupa shell.

Coarctate. Structures which are narrow by being drawn close together; especially the inflorescence of plants.

Coasting. The sport of sliding down hills coated with ice or snow. (The term is also now applied to riding down a decline upon a bicycle, the feet of the rider being lifted from the pedals.) The usual form of sled upon which the coaster rides is that of two runners protected with metal strips and joined by a flat board which forms the seat. In some cases the runners are made from solid plank and in others, like the runners of a sleigh, by bending a narrow piece into the proper form. The most exciting form of coasting is that upon what are known as "bob-sleds" or "double rippers." These are made by joining two sleds by a long plank and thus providing seats for several persons in a line one behind the other. Some of these "bobs" are most elaborate affairs provided with special steering gear and comfortable seats. Tobogganing is another form of coasting in which the sled is a broad flat board curled up at the front. Tobogganing is also practiced upon a slide where a polished surface is provided by artificial means as well as upon natural snow and ice, and the toboggan is also projected from the slide out into a landing surface of water.

Coast Batteries. Permanent works erected in the harbor of an important roadstead, and armed with the heaviest artillery capable of withstanding attack by armored ships.

Coast Ranges. Series of mountains bordering the Pacific coast. In Wash. and n. Cal. they reach nearly 8,000 ft., s. of San Francisco Bay they are in few places much above 4,000 ft., but San Bernardino Mt., east of Los Angeles, is 11,800 ft. high.

Coast Survey. Bureau of the U. S. Treas. Dept. charged with the duty of surveying and mapping the coasts, and with the triangulation of portions of the interior. It also carries on tidal and magnetic observations, has charge of the national standards of weights and measures, and has done much astronomical work for the determination of latitudes and longitudes. It publishes an annual report of progress, and the *Coast Pilot*, together with hydrographic maps of all parts of the coast of the U. S. and Alaska. The work of the Bureau was begun 1807 by F. R. Hassler, who was its superintendent till 1844. Other eminent scientists who have filled the office of superintendent are A. D. Bache, J. E. Hilgard, Benjamin Peirce, and T. C. Mendenhall. Since 1874 its official designation has been the U. S. Coast and Geodetic Survey.

Coated Pane (ELECTRIC). See FRANKLIN'S PLATE.

Coat of Arms. The fashion of embroidering heraldic devices on a surcoat of silk, cloth of gold, or other sumptuous stuff, worn over the hauberk or coat of mail, became general during the 13th century and introduced the terms coat of arms and coat armor.

Coaxial. Having the same axis; used in reference to loci, and to minors in the discussions of determinants.

Cobalt. Co. At. wt. 58.53, sp. gr. 8.9, sp. ht. 0.11. Discovered by Brandt 1742. It occurs in nature as cobaltite and smaltite, and is prepared by igniting the oxide with carbon. It is a reddish-white metal, of strong luster, tenacious, difficultly fusible; attracted by the magnet. Somewhat soluble in hydrochloric and sulphuric acids, readily in nitric acid. It forms two classes of compounds—cobaltous and cobaltic.

Cobaltamine Compounds. Composed of double molecules of cobalt and ammonium salts. Not much is known in regard to them.

Cobalt Bloom. Hydrous cobalt arsenate. See ERYTHRITE.

Cobalt Chloride. $CoCl_2+6H_2O$. Dark red crystals, made by dissolving the carbonate in hydrochloric acid. The anhydrous salt is blue. It is used for making invisible inks.

Cobaltite, or COBALT GLANCE. CoAsS or (CoS_2+CoAs_2). Mineral containing cobalt, arsenic and sulphur; found in Sweden.

Cobalt Sulphide. CoS. Black precipitate, formed by adding a soluble sulphide to cobaltous salts; insoluble in dilute acids.

Cobb, HOWELL, 1815–1868. M. C. from Ga. 1843–51 and 1855–57; Gov. of Ga. 1851–53; Sec. U. S. Treasury 1857–60; general C. S. A., as was his brother, THOMAS R. R., 1823–1862.

Cobb, SYLVANUS, 1823–1887. American novelist, *Gun-maker of Moscow.*

Cobbe, FRANCES POWER, b. 1822 in Dublin. Essayist and philanthropist, disciple and editor of Theodore Parker. *Religious Duty*, 1857; *Broken Lights*, 1864; *Darwinism in Morals*, 1872; *Hopes of the Race*, 1874; *Duties of Women*, 1880; *Spirit of the Age*, 1888; *Life, by Herself*, 1894.

Cobbett, WILLIAM, 1762–1835. English political writer, living 1796–1800 in Phila., where he ed. *Peter Porcupine's Gazette* and was fined for libel, and 1817–19 on L. I., to avoid arrest. From 1802 he ed. the *Weekly Political Register* in London, and was in prison 1810–12; popular lecturer 1829–30; M. P. 1832. His writings are vigorous, but untutored, coarse, and often bitter.

Cobbing. Process of separating rich ore from poor, by small short-handled hammers.

Cobden Club. An English association, formed in 1866, a year after the death of Richard Cobden, from whom its name was taken. Its object was to encourage the growth and diffusion of liberal opinions on political matters, and free trade opinions on economic questions.

Cobden, RICHARD, 1804–1865. English political reformer of high repute and great influence: "apostle of free trade"; M.P. from 1841; associate of John Bright. The abolition of the Corn Laws 1846 was mainly his work.

Cobet, CAREL GABRIEL, 1813–1888. Greek prof. at Leyden from 1847; ed. *Mnemosyne* and sundry classics.

Cobham, SIR JOHN OLDCASTLE. LORD, b. ab. 1360. d. 1417. English Lollard, soldier and courtier; imprisoned 1413. He escaped, promoted a rising 1414, and after three years in hiding was taken and burned.

Coblentz. Old city of Rhenish Prussia, at the junction of the Rhine and Moselle. Pop., 1890, 32,671.

Cobra (*Naja tripudians*). Venomous and abundant snake of India, where more than 5,000 deaths result annually from its bite; it is venerated as especially under the protection of Buddha. Proteroglyphs, flattening the neck, forming a wide hood, on the back of which are peculiar "spectacle" marks; this feature and the general coloration are subject to great diversity. The poison, even from a scratch, is rapidly fatal if the wound be not immediately cut out or cauterized, and sucked. If one of a pair is killed, the mate soon appears to avenge its death. They are ovoviparous, they take to the water readily, and are most active at night.

Head of Cobra.

Coca. *Erythroxylon coca.* Shrub of the natural family *Linaceæ*, native of the Andes; cultivated for its leaves, which are chewed by the Indians for their stimulating effect, and from which the drug cocaine is extracted. Ab. 10,000,000 of the human race indulge in this habit.

Cocaine. $C_{17}H_{21}NO_4$. Mpt. 98° C. Alkaloidal base, active principle of the cocoa-leaf. It crystallizes in colorless prisms. It is sold as the hydrochloric acid salt and is used for a local anæsthetic; "knock-out drops," which have been given in drinks for purpose of robbery, are a solution of this substance. When applied to a raw surface or mucous membrane, or injected beneath the skin, it abolishes temporarily the sensibility of the part, and permits the performance of unimportant operations. It is also used to relieve pain which is limited to small areas. Its habitual use leads to impairment of the functions

of the nervous system and loss of the moral sense; the habit once acquired is more dangerous than that of any other narcotic.

Cocceius, d. ab. 33. Roman jurist; consul 22; grandfather of Nerva.

Cocceius, or **Koch,** JOHANNES, 1603–1669. Prof. at Bremen 1629, Franeker 1636, and Leyden from 1650; author of a Hebrew lexicon 1669, and of the "Federal theology." *Summa Doctrinæ*, 1648.

Coccejus, HEINRICH, 1644–1719. Law prof. at Heidelberg 1672, Utrecht 1689, and Frankfort 1690; Baron 1713. *Juris Publici Prudentia*, 1695.—His son, SAMUEL, 1679–1755, was prof. at Frankfort 1703, Prussian minister 1727, Chancellor 1746, and framer of a code 1747–50.

Coccidæ, or SHIELD-LICE. Of the sub order *Phytophthires*, order *Rhynchota*. The females are large and wingless, sit motionless with their rostrum piercing the bark of plants, and sucking their juices. The eggs (sometimes parthenogenetic) are protected by the dried-up bodies of the mother. The males are small, have large front wings, and sometimes small hind wings. They metamorphose by means of a quiescent pupa, in a cocoon. Cochineal is produced from the dried bodies of the *Coccus cacti*. Some Oriental species cause the trees to extrude lac and manna. Most species are injurious, especially in greenhouses.

Coccidia, or COCCIDIIDEA. Spore-like Gregarines, parasitic in animal cells. They are non-motile, and multiply by spore-formation in the encysted state. Each cyst forms one spore in the *Monosporea*, two or more in the *Oligosporea*, and many in the *Polysporea*. The young that escape from the spores are falciform, and migrate into new cells to form spores.

Coccidium. Sporange of certain Algæ, within which the spores are borne on a central axis.

Coccinin. $C_{14}H_{12}O_5$ or $C_{16}H_{14}O_6$. Yellow powder, made by fusing carminic acid with caustic potash. Its solutions in dilute alkalies absorb oxygen and become green, then purple. The cocinin of commerce is the sodium salt of phenetolazo β-naphthol disulphonic acid.

Coccogones. Propagative cells resembling sporanges, occurring on certain minute *Cyanophyceæ*, and containing conidia.

Coccolite. Granular variety of PYROXENE (q.v.).

Coccoliths. Discoidal, calcareous bodies, less than $\frac{1}{1000}$ of an inch in diameter, abounding in the mud of the deep sea, and in some limestones. Different forms are called Discoliths and Cyatholiths. They are supposed to belong to Algæ.

Coccospheres. Clustered Coccoliths.

Coccosteus. Placoganoid fish with rounded head and triangular body covered with tuberculated plates in front, elongated and less protected behind; characteristic of the Old Red Sandstone of Scotland; found also in the Devonian of America.

Cocculus Indicus. Fruit of *Anomirta paniculata*, a powerful climbing plant of the Malay Archipelago and the Malabar coast. It is very poisonous, and as early as the 16th century was used to stupefy fish for easy capture. It is said to be sometimes employed to render beer bitter. It contains picrotoxine, a crystalline substance, very poisonous.

Coccus. Spherical forms of Bacteria (*Micrococcus*, etc.). Many of the elongated forms pass through a coccus stage at some period of their life-history. Also, the separable one-seeded carpels of some fruits.

Coccus Bacteria. Spherical bacteria. Ordinary *Micrococcus* species are very small; the cells on dividing soon become isolated. In *Streptococcus*, the cells remain attached in the necklace form. *Diplococcus* results from the temporary union of two cocci. In *Ascoccus*, the cocci form large hollow masses. When the diplococcus form divides also at right angles to the first plane of division, a tetrad results, called *Merismopedia;* when this divides so as to form a cube of eight cells, or of several eights, it is *Sarcina*. Streptococcus cells surrounded by a firm gelatinous envelope are the genus *Leuconostoc*.

Coccyges (COCCYGOMORPHA). See CUCULI.

Coccygodynia. Pain in the region of the coccyx, often of an unbearable nature, rheumatic, neuralgic, or due to injury.

Coccyx. Small conical bone at the lower end of the sacrum, formed in man by fusion of from three to five rudimentary vertebræ, which represent those supporting the tail of animals.

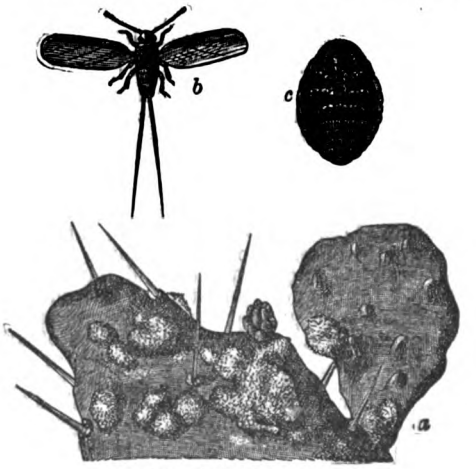
Cochin. State of s.e. India, dependent on Madras. Area 1,361 sq. m., pop. over 600,000.

Cochin-China. Loosely, Anam; specifically, s. part of

Cochin-China.

Indo-China, between Cambodia and the sea; held by France. Area 23,400 sq. m.; pop. ab. 2,000,000. See ANNAM.

Cochineal. Coloring matter, consisting of a dried insect, the females of the *Coccus cacti*, cultivated largely in Central



Cochineal (*Coccus cacti*):
a, living on cactus (*Opuntia*); *b*, male; *c*, female.

America. The active principle is CARMINIC ACID (q.v.). It is used as an indicator in quantitative analysis, and as a dye for silk and wool, giving them a scarlet or crimson color.

Cochlea. One of the three divisions of the internal ear, similar in shape to an ordinary snail shell, and consisting of two coils and a half about an axis or "modiolus." The outer wall is of bone, and the whole is imbedded in the petrous portion of the temporal bone of the skull. Within it is a hollow passage winding spirally to the summit and divided by a plate of bone and two membranes into three canals; the *scala tympani*, facing the base of the cochlea, the *scala vestibuli*, facing the apex, and the *canalis cochlearis*, between the other two. The lower of the two dividing membranes supports the ORGAN OF CORTI (q.v.).

Cochlear. Kind of æstivation in which one petal or segment of the corolla covers the others in the bud.

Cochleate. Coiled like a spiral shell; pods of some plants of the Pea family.

Cochrane, THOMAS, LORD DUNDONALD, 1775–1860. Scottish sailor, M. P. 1807; expelled from Parliament and from the navy 1814, restored 1832; in the service of Chili 1817–23, of Brazil 1823–25, and of Greece 1827–28; Earl 1831; Rear-admiral 1854; buried in Westminster Abbey.

Cockade. Badge or decoration in the form of a ribbon-knot or rosette. During the 18th century it was exclusively a military badge, the white cockade being adopted in France 1767 and giving way to the tricolor at the Revolution. In England the white cockade was the badge of the exiled Stuarts, the House of Hanover bringing in the black.

Cockatoo. Family of Parrots (*Plectolophidæ*) including 32 species, some lately extinct, and mostly confined to the Australo-Malaysian region, and characterized by sharply hooked upper beak, crown of erectile feathers, color generally white. These birds are social, live at top of trees, eat grain and fruits. *Nestor meridionalis*, the Kaka of n. New Zealand, is brown in color and has lately acquired habit of eating flesh from backs of living sheep. Arara Cockatoo (*Microglossa*) is black and 30 in. long. White Crested Cockatoo is 18 in. long, and from Molucca; the Yellow Crested Cockatoo is 22 in. long and from Australia. See PSITTACIDÆ.

Cockatrice. Mythical monster, allied to the Basilisk, with a dragon's tail added. In Isaiah and Jeremiah, a serpent.

Cockburn, SIR ALEXANDER JAMES EDMUND, 1802-1880. M.P. 1847, knighted 1850; Atty.-Gen. 1851; Chief Justice of Common Pleas 1856, and of Queen's Bench 1859; arbitrator of Alabama Claims 1871–72. *Nationality*, 1869; *Charge to Jury in Tichborne Case*, 1874–75.

Cockburn, MRS. ALISON (RUTHERFORD), 1713–1795. Scottish lyric poet.

Cockburn, MRS. CATHERINE (TROTTER), 1679–1749. English dramatist.

Cockburn, SIR GEORGE, 1772–1853. English admiral. He took Washington 1814, and deported Bonaparte to St. Helena 1815.

Cockburn, HENRY THOMAS, 1779–1854. Scottish judge. *Life of Jeffrey*, 1852.

Cocker. Spaniel with silky coat and symmetrical form. The favorite color is jet-black, though liver and white is common in w. England. Intelligent and gentle as a pet, this dog is more prized for his sporting qualities, being an excellent worker at rabbits, pheasants, and partridges.

Cock-Fighting. Sport popular in the East from time immemorial. The Romans introduced it into all the provinces of the empire, and in w. Europe it flourished till modern times, in spite of opposition. In England it was prohibited by Edward III. 1369, Henry VIII., Cromwell 1659, and finally 1849. Under Elizabeth and James I. the cock-pit was as fashionable as the bear-garden, and the "Merry Monarch" built the cock-pit at Whitehall. Besides Greek vases, Pompeian wall-paintings, and engraved gems, art has preserved this sport in two famous pictures by Hogarth and Gerome.

Cockle. *Lychnis githago.* Red-flowered plant of the Pink family, native of Europe; troublesome in wheat-fields because of the dark color imparted to the flour by its black seeds. Since it is an annual and the seed can be easily screened from the wheat, a little careful attention is all that is necessary to keep it in check.

Cocklebur, or CLOTBUR. Plants of the genus *Xanthium*, natural family *Compositæ*, whose involucres become spiny in fruit.

Cockles. See CARDIIDÆ.

Cock-of-the-Rock. *Rupicola.* S. American Passerine, orange-yellow bird of several species, size considerable, and with a crest that extends to tip of beak. The males are most brilliant and execute peculiar dances before the females, at selected localities in the breeding season.

Cockroach. *Periplaneta orientalis.* See BLATTIDÆ.

Cocks. See VALVES.

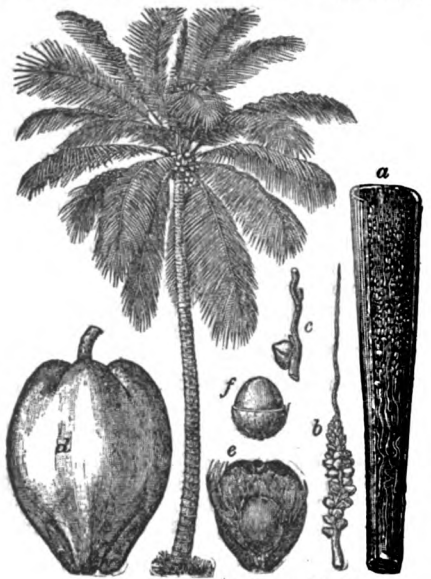
Cockscomb. *Celosia cristata.* Herb of the Amaranth family, native of India, cultivated as a garden plant.

Cockton, HENRY, 1807–1853. English novelist. *Valentine Vox*, 1840.

Cocles, HORATIUS. Roman defender of the Sublician bridge against Porsena and the Etruscan army, 507 B.C.; celebrated by Livy and Macaulay.

Cocoa. See CHOCOLATE BEAN.

Cocoanut. *Cocos nucifera.* Palm, native of thettropical Pacific islands and adjacent coasts, now universally distributed



Cocoanut Palm (*Cocos nucifera*):
a, portion of young spathe, with inclosed inflorescence; *b*, branch of spadix; *c*, smaller portion enlarged, showing a female flower below and male flower above; *d*, cocoanut–*e*, husk cut open, showing hard endocarp, at *f* opened to show the single seed.

in tropical regions and cultivated for its fruits, which furnish a great variety of useful products.

Cocoa Plum. Fruit of *Chrysobalanus icaco*, a small tree of the natural family *Rosaceæ*, native of tropical regions, occurring in Florida.

Cocoon. Pupa case made of silk fibers spun by the larvæ of *Lepidoptera* and some other insects when ready for their transformation into the pupa stage of development. A very delicate cocoon lines the inside of the wax-cells of the bees' honeycomb. The fibers are formed by hardening of a fluid poured out by the sericeous glands, usually modified salivary glands. In the silkworm cocoon the double thread so produced is 4,000 yds. long, and if the cocoon is gathered when completed, the inclosed pupa being killed, one-fourth of the thread can be unreeled as raw silk of commerce.

Cocytus. River of the lower world.

Cod. See ANACANTHINI and GADIDÆ.

Codazzi, AGUSTIN, 1792–1859. Italian engineer and cartographer, employed in S. America. *Geography of Venezuela*, 1841.

Coddington, WILLIAM, 1601–1678. Founder of the R. I. Colony 1638; Gov. of R. I. 1640–47 and 1674–75.

Code. Systematic statement of legal rules on one or more topics, duly enacted by the State. Among the most famous codes are Justinian's, Napoleon's, Livingston's for La., and those drafted by a N. Y. commission, and adopted in whole or in part by several States.

Code Napoleon. Complete system of law, without entire regard to precedent or custom, established as the best law for the whole of France. Napoleon's commissioners for this purpose, with M. Tronchet at their head, completed this unification in 4 mos. and the Council of State considered and promulgated its 2,281 sections between 1804 and 1810. It consists of five parts: Code de Procédure Civile, Code de Commerce, Code d'Instruction Criminelle, Code Penale, and Code Civile. This has worked so satisfactorily that other countries have adopted it, notably Belgium, Italy and Greece.

Codeine. $C_{18}H_{21}NO_3$. Mpt. 150° C. Methyl-morphine, prepared from opium, in which it occurs with morphine, and also from morphine; crystallizes in small needles; a mildly narcotic alkaloid used in treatment of diabetes. See MORPHINE.

Codex. Trunk of a tree, thence wooden tablet, and what is written thereon: name given to ancient MSS. of the Scriptures, either uncial (in capitals) or cursive. The latter are in small letters, and date from 700 on. The most notable codices are the Alexandrian, brought from Constantinople to England 1628, and the Sinaitic, found by Tischendorf 1844.

Codicil. Addition to a will as originally executed, forming a part of the will thereafter. Hence if properly executed it will cure a defective execution of the original will.

Codling Moth. *Carpocapsa pomonella.* Adult moth is nocturnal, half inch across wings; fore wings gray with wavy brown lines and bronzed area, hind wings brown. Eggs (50) laid on blossom end of apple; larva on hatching bores into fruit and grows to ¾ in. in twelve days. In a month bores out of side of fruit, crawls into a crevice of bark of tree, where it transforms into adult. Second brood larvæ spend winter in apple. Originally from Europe. Also infests pear, etc. Spray with 1 lb. Paris green to 200 gal. water at time of fall of bloom, repeat few days later. A bandage about tree gathers cocoons that may be destroyed from week to week.

Codliver Oil. When pure, obtained from the fresh livers of the common cod, but often adulterated by that of the livers of the hake, haddock, and other fish akin to the cod; by far the best form in which fat can be administered, being mixed with certain elements of the bile, and consequently more digestible. It has greatly lessened the mortality of consumption and all forms of disease in which loss of flesh is a prominent and important symptom.

Codonieæ. Family of *Hepaticæ*, of the order *Jungermanniaceæ.*

Codonostome. Orifice of the umbrella of a jelly fish.

Codrington, Sir Edward, R.N., 1770–1851. Distinguished at Trafalgar 1805, and Navarino 1827; M. P. 1832–39; Admiral 1837.—His son, Sir William John, 1804–1884, had command in the Crimea 1855.—His brother, Sir Henry John, 1808–1877, was an admiral.

Codrus. Mythical last King of Athens, self-immolated for the state ab. 1068 B.C.

Cæcilia. See Gymnophionia.

Cæcum. The beginning and first division of the large intestine. It is a large saculated dilatation one inch long, situated on the right side within the abdomen just to inner side of the projection of the hip-bone.

Coefficient. Multiplier denoting how many times the quantity to which it is attached is taken as a term. Coefficients may be numerical or literal. In commutative algebra, different elements may be thus taken; *e.g.*, in "*axy*." *a* may be taken as the coefficient of *xy*, *ax* as that of *y*, etc. In common usage, the coefficient precedes the quantity which is taken as the base of the expression.

Coefficient of Absorption (Heat). If a body of surface S be exposed in a closed chamber the temperature of which differs from that of the body by a few degrees δ, then the body gains or loses per unit of time $AS\delta$ units of heat, where A is a constant depending on the nature of the body and of its surface, and is called the coefficient of absorption, if the temperature rises, or of emission if it falls.

Coefficient of Conductivity (Heat). Amount of heat that will flow in one unit of time from one side of a unit cube of any substance to the opposite side when the difference of temperature between the two sides is 1° C. This definition was first suggested by Fourier.

Coefficient of Contraction. Ratio of the least cross-section of a stream of water to that of the area of the orifice from which it issues. For an orifice in a thin plate this ratio is about 0.62. For an orifice with rounded edges it is between 0.62 and 1.00.

Coefficient of Elasticity. Ratio of the unit-stress to the unit-elongation when the elastic limit is not exceeded; or force per unit of section which would stretch a bar to double its length if its elasticity were not impaired. If P be the tensile force which stretches a bar, A the area of its cross-section, l its length and s its stretch caused by the tension, the coefficient of elasticity is $E=\frac{P}{A}\div\frac{s}{l}=\frac{Pl}{As}$. The mean value of E for timber is 1,500,000 pounds per sq. in., for cast iron 15,000,000, for wrought iron 25,000,000, and for steel 30,000,000.

Coefficient of Emission. See Coefficient of Absorption.

Coefficient of Expansion. The coefficient of linear expansion is the increase per unit length of a body when its temperature is raised from 0° to 1° C. If L_t be the length at temperature t° and L_0 that at temperature 0°, then $L_t=L_0(1+\alpha t)$ in which α is the coefficient of expansion. In this expression $1+\alpha t$ is called the "expansion factor."

The coefficient of superficial expansion is approximately twice that of linear; and the coefficient of cubic expansion three times that of linear. The coefficient of expansion for solids is in general less than that of liquids, and that of liquids less than that of gases. Platinum and glass have the same expansion coefficient (from 0.0000086 to 0.0000088), hence they can be worked together in places subject to wide range of temperature. Few substances have negative expansion coefficients, notably the iodides of lead and silver, and water from 0° to 4° C. In crystals the expansion is usually different along the different crystalline axes. All gases have approximately the same coefficient of expansion (viz., 0.003665 or $\frac{1}{273}$), so that if the pressure be kept constant the volume of a mass of gas at t° is given by the expression $V_t=V_0(1+0.003665\ t)$ in which V_0 is its volume at 0°. Expansion of liquids may be said to be of two kinds, apparent or real. The former is the apparent increase of volume in a vessel which expands also, though to a less extent, than the contained fluid. By real expansion is meant the true expansion of the fluid without reference to the containing vessel. For wrought iron and steel its value ranges from 0.0000065 to 0.000075. In continuous bridges and fixed metallic arches the stresses due to changes of temperature are often large and must be carefully provided for.

Coefficient of Extensibility. Elongation produced by a force of 1 dyne in a wire of any material 1 centimeter long and having a sectional area of 1 square centimeter. If l be the length of any wire, a its cross-section, f the force applied, and e the extension produced,

$$E=\frac{ae}{fl}$$

where E is the coefficient of extensibility.

Coefficient of Friction. Ratio of the tangential force necessary to start or maintain relative motion of two surfaces in contact, to the normal pressure between the surfaces. In the former case the ratio is the coefficient of static, in the latter of kinetic, friction.

Coefficient of Induction. Ratio of the variation of charge developed in a conductor, B, to the potential of a conductor, A. As the coefficient of induction of A on B is always equal to that of B on A, this quantity is sometimes called the coefficient of mutual induction.

Coefficient of Magnetic Induction. If a magnetic substance be suspended in a magnetic field, the magnetic induction within the magnet varies with the strength of the field, and is equal to that strength multiplied by a constant *u*, which is different for different magnetic substances. The constant is called the "coefficient of magnetic induction," or the magnetic permeability of the substance.

Coefficient of Mutual Induction (Electricity). Ratio of the flow of force in a secondary circuit to the strength of the current flowing in the primary or inducing circuit. The units are the same as those of Self-Induction (q.v.).

Coefficient of Restitution. Term referring to volume elasticity; measure of the force with which a body after compression tends to return to its original volume. The reciprocal of compressibility, and equals $\frac{Vp}{v}$ in which V is the initial volume of a body, p the increase of pressure which produces a decrease of volume v. The internal reaction produced in an elastic body by compression or distortion is called the "restitution pressure."

Coefficient of Rigidity. Ratio of any stress applied to the resulting strain. As no body is perfectly rigid, this coefficient is always finite. In fluids it is zero.

Coefficient of Saturation. Constant relating to the Saturation (q. v.) of a magnetic field. Often denoted by σ.

Coefficient of Self-Induction (Electricity). Quantity of induced electrification developed in a coil of insulated wire, assumed to be of unit resistance, when unit current through it is made or broken. See Self-Induction.

Coefficient of Solubility. Number indicating the amount of a solid which can be dissolved and remain in solution in unit mass of a liquid at a fixed specified temperature. With a few exceptions it increases with the temperature.

Coefficient of Transformation (Electric). Ratio of the electromotive forces or the inverse ratio of the current strengths in the two coils of a transformer.

Coefficient of Transmission. If i denote the intensity of a beam of light incident on the surface of any medium, and $i\alpha$ the intensity after it has traversed one unit of thickness of this medium, α is called the "coefficient of transmission." In general the intensity of the light I, after traversing a thickness δ, will be given by the formula $I=i\alpha^{\delta}$. α is found to be different for lights of different colors, and hence if the incident light be white, the emergent beam will be colored, the tint usually deepening with the thickness of the medium traversed. See Dichroism.

Coefficient of Transpiration. A constant in the phenomenon of TRANSPIRATION OF GASES (q. v.), which depends on the conditions of the experiment and on the nature of the gas employed.

Coefficient of Viscosity. Ratio of any shearing stress applied, to the resulting shear per unit of time.

Coehorn, MENNO, BARON VAN, 1641–1704. Dutch military engineer, inventor of the mortar; famous for his siege-works. *Fortification*, 1685.

Coehorn Mortar. Small bronze shell-gun weighing ab. 170 lbs., designed by Gen. Coehorn to throw a 24-lb. shell into the trenches of a besieger. It can easily be moved by hand from place to place.

Cœlacanthus. Crossopterygian lepidoganoid fish of the carboniferous and later rocks, with diphycercal tail, circular scales, hollow fin-rays, two dorsal fins, each supported by a single interspinous bone, and an ossified air-bladder.

Cœlenterates (CŒLENTERATA or CŒLENTERA). Sac-shaped, radially symmetrical animals, with a two-layered body wall inclosing a gastro-vascular cavity. The mouth is at one end, and usually surrounded by a circle of tentacles. They are divided into the classes: *Anthozoa* (*Actinozoa* or Zoöphytes), and the *Hydrozoa* (Hydroids, Medusæ or Jellyfish). Usually the *Ctenophora* and even the Sponges are also included, and the group then divided into Sponges and *Cnidaria*.

Coelho, GONZALO. Portuguese seaman who explored the coast of Brazil 1504–5.

Coelho Pereira, DUARTE, ab. 1485–1554. Portuguese colonist in Brazil; Gov. of Pernambuco 1534. In this post he was succeeded by his son DUARTE, 1537–ab. 1579, who with his brother JORGE, 1539–ab. 1600, was made captive by the Moors in Africa. Jorge's son, DUARTE, 1591–1658, was Gov. of Pernambuco, and pub. *Wars of Brazil*, 1654, drawn in part from his father's MSS.

Cœlian Hill. One of the Seven Hills of Rome, extending from the Palatine to St. John Lateran.

Cœlom. "Body cavity," formed by special pouches from the archenteron; process much obscured by cenogenetic factors in most vertebrates.

Cœlomata. Animals possessing a true body cavity, which appears in the embryo as a space bounded by the two layers of mesoderm. Except a few worms, all animals above the Cœlenterates are thus characterized.

Cœlospermous. Fruits of the Carrot family, hollowed on the inner surface.

Cœnanthium. See CLINANTHIUM.

Cœnenchyma. Common calcareous, uniting substance between coral calycles, or corallites of a compound corallum.

Cœnobe. Loose association of cells characteristic of some of the lower Algæ; sometimes fruit of the natural families *Boraginaceæ* and *Labiatæ*.

Cœnobieæ. Order of Algæ, composed of species producing cœnobes.

Cœnocyte. Vegetable structure or organism not differentiated into cells.

Cœnœcium. Polyzoary, or polypidom, the entire system of united polyps of *Polyzoa*.

Cœnosare. Fleshy or protoplasmic part connecting the different polyps of a compound Hydroid.

Cœnosteum. Calcareous skeleton of Millepores.

Cœnurus Cerebralis. Bladder-like embryo of *Tœnia serrata*, a tape-worm inhabiting dogs, which are found in the heads of sheep, causing staggers or gid.

Cœpas. Child's game in Costa Rica and Nicaragua; played with slightly rounded disks of beeswax, ab. 1½ in. in diameter. One player lays a disk on the ground; another throws a similar disk at it, and endeavors to turn it over. If he succeeds he wins, otherwise the first takes both pieces.

Coercive Force. Property of a magnetic substance by which it offers resistance to being magnetized or demagnetized. Steel has a high coercive force; soft iron almost none at all. This property may be modified by treatment, heating, hammering, etc.

Cœrulein. Alizarine green. Anthracene green. $C_{20}H_8O_6$. Dark green paste, prepared by heating phtalic anhydride with gallic or pyrogallic acid. It gives a green upon cotton mordanted with chrome. Coerulein δ is a combination of the compound described above with sodium bisulphite.

Coffee. *Coffea arabica*. Shrub of the natural family *Rubiaceæ*, native of Abyssinia, now widely cultivated in warm countries for its seeds, which when roasted and ground form the basis of the important beverage; it then contains 1.3 per cent caffeine, to which its properties are due.

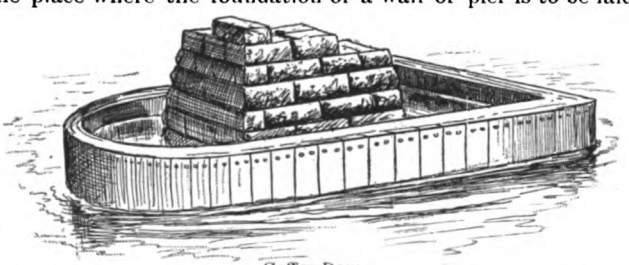
Coffee: branch with fruit.

Coffee-Houses. First opened by Jacobs, a Jew, in Oxford, 1650, and by Pasquet, a Greek, in Lombard St., London, 1652. They immediately became fashionable as the resorts of the poets and wits, the great marts of news and gossip, and an important factor in the forming of public opinion. In 1675 the government became alarmed at the political influence of the coffee-houses and shut them up, only reopening them on condition that the proprietors should prevent their customers "uttering scandalous reports against the government or the ministers." Clubs were only a development of these coffee-houses.

Coffee Tree, KENTUCKY. *Gymnocladus dioica*. Large tree of the natural family *Leguminosæ*, native of the s. U. S.

Coffer. In architecture, same as caisson. Also an ornamental panel.

Coffer-Dam. Usually of timber and clay, built around the place where the foundation of a wall or pier is to be laid,



Coffer-Dam.

in order to exclude the water; available only for depths of water less than 15 ft., on account of the expense of construction and pumping. The figure shows a small dam made of jointed timbers.

Coffering. Method of lining a mine shaft with brick and cement backed with clay.

Coffin. Case in which the body is interred. The Egyptians used an inner mummy-case, usually of sycamore wood, as well as the outer one elaborately decorated. The Sassanians used coffins of glazed earthenware, and single blocks of stone hollowed out to the shape of the body may be seen in every ancient church. See DISPOSAL OF THE DEAD.

Coffin, CHARLES, 1676–1749. Latin poet, head of college at Beauvais 1712, and rector Univ. Paris 1718. His hymns were adopted by the Paris Breviary 1736, and some of them are known in English versions.

Coffin, CHARLES CARLETON ("CARLETON"), b. 1823. American journalist and author, chiefly of war stories for the young. *Boys of '76*, 1876.

Coffin, JAMES HENRY, 1800–1873. Prof. Mathematics and Astronomy in Lafayette Coll. First in America to construct a simple form of self-register for the direction of the wind. *Winds of the Globe.*

Coffin, WILLIAM ANDERSON, b. 1855. American painter. *Evening; Twilight; Early Morning; Moonlight in Harvest.*

Coggeshall, GEORGE, b. in Conn. 1784. Commanded two privateers in war of 1812, and wrote the history of privateering

in that war. *Commerce and Navigation from the Birth of our Saviour down to Present Date; Voyages to various Parts of the World*, 1799-1844.

Cognac. See BRANDY.

Cognition. Function of the mind by which we have knowledge of anything. In a tripartite analysis of consciousness it is the intellectual aspect as distinguished from the emotional and volitional. The necessary preliminaries to any cognitive act are the presentation of an object to the mind and the fixing of the attention upon it; following this come the higher processes of perception, interpretation, recognition, etc. The presentative material may be internal facts, such as are involved in the inspection of one's own state of mind, or external matters of sense experience. See PSYCHOLOGY.

Cognovit. Written acknowledgment of a claim, and authority to the owner to enter judgment thereon; confession of judgment. Its form and use are now generally regulated by statute.

Cog Wood. In Jamaica, *Zizyphus chloroxylon*, a tall tree of the natural family *Rhamnaceæ*, producing very hard wood, used in machinery.

Cohesion. Mutual attraction between molecules. It varies in amount with different substances and with any change of state in the same substance. It is less active in liquids than in solids, and is entirely wanting in the gaseous state. Between two surfaces it resists their separation when they are pulled apart in a direction perpendicular to the plane of contact. Dry earth has little cohesion, but damp earth has a cohesive force of 50 lbs. or more per foot of surface.

Cohesion. Botanical term for the adhesion of parts of the same cycle in flowers.

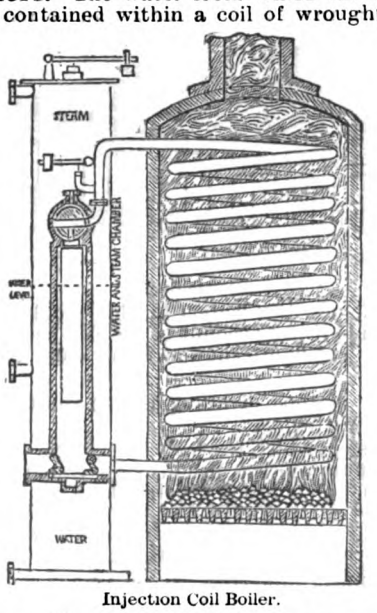
Cohesion Figures. Forms assumed momentarily by drops of liquid when they come in contact with other bodies. The phenomenon is one of surface tension, and the edges of the spreading drop break up into nodes and loops which vibrate in periods depending upon the viscosity and surface tension of the liquid.

Cohoes. City of Albany co., N. Y., at junction of the Hudson and the Mohawk; chartered 1869. It has manufactures of cotton and woollen goods and edged tools. Pop., 1890, 22,509.

Cohort. In Biology, group of orders or families of plants or animals.

Cohosh, BLUE. *Caulophyllum thalictroides.* N. American plant of the Barberry family, also called Pappoose-root.

Coil Boilers. The water from which the steam is to be generated is contained within a coil of wrought iron pipe of



Injection Coil Boiler.

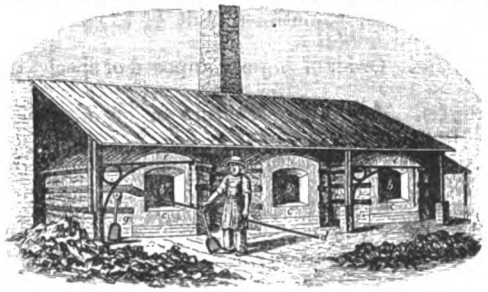
small diameter. The coil is usually a tapering helix, on account of expansion and for the circulation. Such boilers are safe and efficient, a small size generating steam for a relatively large engine; are adapted for high pressures, but it is difficult to keep a uniform pressure on account of the small volume of water which they hold. The best results are secured where the water is circulated mechanically in the coil.

Coin, or QUOIN. Wedge formerly used in elevating iron mortars or siege guns.

Coinage. Fashioning of pieces of metal and impressing them with suitable devices for use as money. The need of some convenient measure of representative of value has been recognized from the early ages of the world. Gold and silver were used for purposes of ornament before they were coined. Herodotus says that the Lydians first coined money, and the coins of Sardes, 800 B.C., are thought to entitle them to the honor. The Chinese, however, assert a much greater antiquity for their coins of copper and iron. "Coinage," said Jefferson, "is peculiarly an attribute of sovereignty." The interests of the people require that the right to coin money should be reserved to the government. The coins of empires and monarchies bear the likeness of the sovereign reigning at the date of their issue, while those made by republics or free States have usually some device emblematic of the people or State authorizing their coinage. The devices on coins are of a varied character. Some consist of simple letters or figures stamped or punched in the rudest manner, while others are of the most beautiful form that can be engraved on metal. Ancient coins comprise the coinage of Europe, Egypt and Asia, to the period when the barbarians invaded Europe, putting a stop to the old arts; and are chiefly those of the Greek cities, the Roman, Republic and Empire, the Persian or Parthian, and the Byzantine. The Greek coins are the oldest extant, and were first struck in gold and silver. They are of various designs, from the rudely struck didracham of Ægina, ab. 800 B.C., to the highly finished coins of Sicily and s. Italy, 400–200 B.C., with rarest devices on both sides and elaborate inscriptions. A silver currency was introduced in Rome and a mint established in the temple of Juno Moneta, 269 B.C.; gold was coined 206 B.C. In England the first gold coin on record was struck 1257; sovereigns were struck 1489, shillings 1503, crowns 1553. In the U. S. the first colonial coinage was in Mass. 1652. Vt. and Conn. coined copper 1785; N. J. and Mass. 1786. In the U. S. decimal coinage was adopted; gold eagles and half-eagles, with silver dollars and divisions of a dollar were issued from 1794–96, and cents and half-cents from 1793. The mechanical execution of American coins is perfect, but the designs have often been criticised as inferior to those of the other leading nations. To insure sufficient hardness, 1 part of alloy is almost universally put with 9 parts of pure gold or silver, but in England the ratio of copper to gold is 1 to 11. India has the same ratio (1 to 11) also for silver. See ASSAY.

Coincidence. Magnitudes coincide when, being placed one upon the other, they agree throughout. Coincident points or lines, while having the same position, may have different tendencies.

Coke. Fuel made by carbonizing coal, *i.e.*, by heating coal to redness without access of air. The only coals suitable for coking are the caking, BITUMINOUS COALS (q. v.). On coking these, the volatile matter given off contains tar, ammonia salts, and illuminating gases; if they are passed into condensers the tar and ammonia are saved, while the illuminating gas is passed on into storage holders. If it is desired to coke the coal in the simplest way without saving the volatile matters, the coal is heaped into a circular mound or pile like a charcoal heap, with a chimney in the center. Sometimes the piles of coal



Coke Ovens.

are made rectangular in form, 150 to 200 feet long. The fire is prevented from burning too fast by covering the outside of the pile with fine coal-dust or coke-dust, and in this way only a very small amount of air gets into the heap, the result being that part of the coal is completely burned, and its heat cokes the rest. These ways of coking are very wasteful, the percentage of coke obtained being smaller than when kilns are used. The bee-hive coke-oven is largely used in the U. S., as in making the famous Connellsville coke. It consists of a cylindrical chamber with a dome-shaped roof, through a hole in the top of which the volatile ingredients escape and burn. They are built in rows of 50 or 100, all served by a car running on a track above them. The operation consists in dropping the coal into the hot oven, and then limiting the admission of air to the grate below so that just enough combustion takes place to keep the oven hot. When all the volatile matter is expelled, the hot coke is drawn into a pit in front of the oven, or into an iron car, which can be closed tight, and there allowed to cool, sometimes being cooled more quickly by water. Numerous ovens have been devised with the object of saving the products

of distillation as in gas-making, without making the operation so slow or requiring such expensive apparatus. Such plants have recently been established in Germany, and it is stated that the distillation products are more valuable than the coke produced, in one case four gallons of tar useful for aniline manufacture and two lbs. of sulphate of ammonia being produced from a ton of coal. In the best practice the coal is crushed and washed before coking to separate the slate and thus reduce the impurities. Good coke is hard, strong, with a metallic luster and ring, and burns with a short, blue flame, making a very hot fire. It usually contains over 90 per cent of carbon, 3 to 10 per cent of ash, and a small quantity of combined volatile matter. It absorbs very little moisture from the air, and has an evaporative efficiency of ten to twelve times its weight of water. Good coal yields from 50 to 60 per cent of coke, by weight.

Coke, Sir Edward, 1552–1634. English Solicitor-Gen. 1592; Atty.-Gen. 1594; Chief-Justice of Common Pleas 1606, and King's Bench 1613. *Reports* from 1572–1617; *Institutes of the Laws of England*, 1628–44. He resisted tyranny, was imprisoned 1621, and urged the Petition of Rights 1628.

Coke, Thomas, D.C.L., 1747–1814. Methodist missionary, sent to America by Wesley as superintendent 1784, and entitled Bishop by the Conference. He was active in travels, labors, and futile efforts to unite the P. E. and M. E. Churches.

Col. Region on the weather map in which the isobars between two anti-cyclones show a connecting neck of low pressure. —In Switzerland, a pass between two adjacent mountain peaks.

Cola Nut. *Cola acuminata.* Large tree of the natural family *Sterculiaceæ*, native of tropical w. Africa. Its seeds are esteemed by the natives on account of their supposed stimulating properties.

Co-Latitude. Complement of the latitude, or 90° minus the latitude.

Colban, Adolphine Marie (Schmidt), 1814–1884. Norwegian novelist.

Colberg. Prussian seaport, taken by the Russians 1761, besieged by the French 1807. Pop. ab. 17,000.

Colbert, Jean Baptiste, 1619–1683. Fr. minister of finance 1661–83. He reformed the odious fiscal system, stimulated commerce, founded a marine, and patronized art and letters.

Colby University. At Waterville, Me.; controlled by Baptists; chartered by Mass. 1814, and as Waterville College by Me. 1821; name changed 1867. It has funds of $525,000, a library of 29,000 vols., 13 instructors, and ab. 220 students, of both sexes.

Colchester. Town of Essex, site of the earliest Roman colony in Britain; taken by Fairfax, Aug. 1648. Pop., 1891, 34,559.

Colchicum. *Colchicum autumnale.* Plant of the Lily family, native of s. Europe, cultivated for its medicinal properties; known also as Meadow Saffron. Used chiefly to relieve the pains of gout and rheumatism, but poisonous in large doses.

Colchicum autumnale.

Colchis. Region of Asia, e. of the Euxine and s. of the Caucasus, to which the Argonauts sailed.

Colcothar. Ferric oxide, made in the manufacture of Nordhausen sulphuric acid; used for polishing purposes.

Cold. (1) Acute inflammation of the mucous membranes of the air passages, especially when caused by exposure to cold. (2) Chilling of the body followed by neuralgia, rheumatism, suppression of the menses, or any acute inflammatory disease.

Colden, Cadwallader, 1688–1776. First Surveyor-Gen. of N. Y. 1719; Lieut.-Gov. 1761–75.

Cold Harbor. In Hanover co., Va.; scene of battles June 1–3, 1864, between Grant and Lee. Union loss ab. 7,000. See Gaines' Mills.

Cold-Rolled Shafting. Round rods made by the ordinary process, dipped in a pickling bath of dilute sulphuric acid to remove scale, and then passed through the passes of a train of polished rolls (see Roll-Train) while cold. The pressure of the rolls produces a hard, bright, smooth and cylindrical surface, and fits the rods for uses where they will be exposed to abrasion, as in piston-rods, shafting, etc. The labor of turning is replaced by the rolling. See Shafting.

Cold Wave. Broad, comparatively shallow or thin layer of cold dry clear air advancing as a whole s. and e. over the U. S. and Canada, but sometimes pouring over the Rocky Mts. into the valleys of the Pacific coast. Unless this air gives rise to a fall of more than 20° F. and to temperatures lower than 40° F., it is called a cool wave. Similar waves occur in Europe and Asia, but not in Africa or S. America.

Cold Wave Signal. Introduced by U. S. Signal Office in 1881 to announce the occurrence within 24 hours of a decided fall of temperature.

Cold Well. Reservoir from which the cold water is drawn to condense the exhaust steam in a condensing steam engine. In marine practice it is the water in which the vessel travels; an injection valve in a copper pipe from a hole in the hull below the water line controls the flow of water into the condenser. In older land practice the condenser and air pump were immersed in the cold well below the engine bed-plate. Water enters the condenser by atmospheric pressure, but the cold well has to be supplied from outside sources.

Cole, Thomas, 1801–1848. Anglo-American painter. Especially famed are his two imaginative series *The Voyage of Life* and *Course of Empire*, the latter held by the N.Y. Historical Society.

Colebrooke, Henry Thomas, 1765–1837. Anglo-Indian official and Sanskrit scholar, grammarian, and translator.

Colemanite. White hydrous calcium borate, found in Cal.

Colenso, John William, D.D., 1814–1883. Bp. of Natal, S. Africa, 1853. His first books were on mathematics; his *Commentary on Romans*, 1861, and *Pentateuch*, 1862–79, caused much scandal by their alleged heresies. The Bp. of Capetown deposed him, but the civil authorities supported him. He was a man of high character, an earnest and efficient missionary, and a firm friend to the Zulus and to justice in their behalf.

Coleochætaceæ. Order of small fresh water green Algæ growing on submersed vegetation.

Coleophyllum. Membrane which covers the plumule in monocotyledonous plants.

Coleoptera (Order of Insecta). Of which over 80,000 species have been described. Beetles have masticating, often pincer-like, mouth parts, and have the front wings modified into horny wing-covers (elytra) which nearly or quite cover the soft abdomen, their inner edges meeting when at rest, and the outer edges curved around the abdomen. The hind wings, which alone are used in flight, are membranous and fold up under the elytra, when at rest. The head is sunk into the large and free prothorax. The antennæ are usually eleven-jointed and peculiarly formed in the male. The development is by complete metamorphosis, from grub-like larvæ, usually furnished with thoracic legs and a few pro-legs, but some are apodal. The pupæ have freely projecting legs and are either suspended from objects or lie in the ground. There are four tribes based on the number of joints in the tarsus, *Trimera*, *Tetramera*, *Heteromera*, and *Pentamera;* but an extra rudimentary joint is present in the first two, thus raising their rank.

Coleorhiza. Tissue found at the bases of the roots of certain plants, as some grasses; membrane covering the embryo in the seeds of some monocotyledonous plants.

Coleridge, Hartley, 1796–1849. English poet and essayist, son of S. T. *Worthies of Yorkshire and Lancashire*, 1836.—His cousin, Henry Nelson, 1800–1843, wrote on the Greek poets 1830, and with his wife, Sara Henry, 1802–1852, daughter of S. T., edited her father's writings.

Coleridge, John Duke, Lord, 1821–1894. Atty.-Gen. 1871; Baron 1873; Chief-Justice of Common Pleas 1873, and of Queen's Bench 1880. *Law of Blasphemous Libel*, 1883.—His father, John Taylor, D.C.L., 1790–1876, nephew of the poet, Justice of King's Bench 1835, edited *Blackstone*, 1825.

Coleridge, SAMUEL TAYLOR, 1772–1834. English poet of the Lake School, also an essayist, critic, and philosopher, the first prominently to introduce German thought to English readers. His most remarkable poems are *The Ancient Mariner*,

Samuel Taylor Coleridge, age 26.

1798; and *Christabel*, 1816. His views on religion and politics were brought out in *The Friend*, 1809–12, and *Biographia Literaria*, 1817. His theology was mainly outlined in *Aids to Reflection*, 1825.

Colet, JOHN, D.D., 1466–1519. Dean of St. Paul's, London, 1504; founder of St. Paul's School 1512. With Wm. Lilly, its head master, he wrote a Latin grammar that was long in use. He was a man of learning and of advanced views, on some points anticipating the Reformation.

Coleus. Genus of herbs of the natural family *Labiatæ*, natives of warm parts of the Old World, much cultivated for their ornamental red leaves.

Colfax, SCHUYLER, 1823–1885. M. C. from Ind. 1855–69; Speaker 1863–69; Vice-pres. 1869–73.

Colgate University. At Hamilton, N. Y.; controlled by Baptists; chartered as Madison Univ. 1846; name changed 1890. It has 15 professors, ab. 150 students, a library of 23,000 volumes, and funds of ab. $1,500,000, with an academy and a theological department.

Colic. Pain in the intestines, caused usually by accumulations of gas or undigested food, and occasionally by chronic lead poisoning.

Colic Root. *Aletris farinosa.* White-flowered plant of the natural family *Liliaceæ*, native of s. e. N. America; called also Stargrass.

Coligny, GASPARD DE CHATILLON, COUNT, 1517–1572. Admiral of France; Huguenot leader from 1559; first victim of the massacre of St. Bartholomew.

Colima. City of w. Mexico, founded by Sandoval 1522. Pop. ab. 26,000.

Coliseum. See COLOSSEUM.

Collamer, JACOB, LL.D., 1792–1865. Justice Supreme Ct. of Vt. 1833–42; M. C. 1843–49; Postmaster-gen. 1849–50; U. S. Senator from 1855.

Collapse. Sudden and great prostration, accompanied usually by cold sweats, weak pulse, feeble respiration, ringing in the ears, and weak vision; due to injury or disease; *e.g.*, Asiatic cholera.

Collar. Set of timbers at mouth of a mine shaft.

Collar Beam. Beam connecting two opposite rafters of a roof at a height ab. half the rise of the roof; often inserted to act as a tie rod and prevent the spreading of the rafters.

Collar Bone. See CLAVICLE.

Collateral. Fibro-vascular bundles of plants having a strand of wood next to one of bast-fibers.

Collateral Circulation. Through smaller arteries of a part and their connections, after the principal artery is tied.

Collateral Inheritance Tax. Levied on property bequeathed to any other person than a direct descendant or parent.

Collect. Condensed prayer, commonly from the ancient liturgies; often remarkable for comprehensiveness and devout beauty of expression.

Collective Fruits. See MULTIPLE FRUITS.

Collective Goods. Goods which have value to individuals, but are not in private ownership; as the right and opportunity to make use of public roads, streets, gaslight, education, and the courts of justice.

Collectivism. Principle or system which would concentrate the control of the industrial occupations and interests of society in the hands of the people collectively, *i.e.*, the State or some of its subdivisions, instead of leaving them to individual effort and control.

Colleges of the U. S. Oldest are Harvard, founded 1650; William and Mary, 1693; Yale, 1701; Col. of N. J. (Princeton), 1748; Columbia, 1754; Univ. of Pa., 1755; Brown, 1764: Dartmouth, 1769; Rutgers, 1770; Washington and Lee, and Washington (Md.), 1782; Hampden Sidney, and Dickinson, 1783; St. Johns, Md., 1784; Charleston, and Univ. of Ga., 1785; Univ. of N. C., 1789; Univ. of Vt., 1791; Williams, 1793; Bowdoin, 1794; Union, 1795.

Collegiate Reformed Church. Society in N. Y. City, having three churches, mission chapels, and several pastors.

Collemaceæ. Order of discocarpous Lichens.

Collembola. See THYSANURA.

Collenchym. Gelatinous matrix of sponges, when it is clear and abundant, the cells and granules being relatively few.

Collenchyma. Vegetable tissue composed of elongated cells, whose walls are considerably thickened at the angles, so as to possess great strength.

Collencytes. Cells that secrete the gelatinous matrix of sponges. They are branched and may presumably be united by their branches, acting as a sort of ganglionic co-ordinating system.

Colles Fracture. Fracture of the lower end of the radius (forearm), with a backward displacement of the lower fragment.

Colleterium. Organ in insects which secretes the gluten that cements ova together as laid in masses.

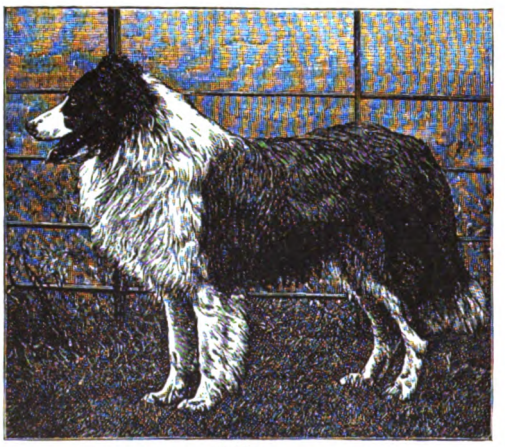
Colleters. Glandular hairs borne on the bud-scales of certain plants.

Collett, JACOBINE CAMILLA, 1813–1891. Norwegian novelist.

Colletta, PIETRO, 1775–1833. Italian historian. *Kingdom of Naples from 1734 to 1825*, 1834.

Collidines. $C_5H_2(CH_3)_3N$. Three varieties. Trimethyl pyridines, derivatives of pyridine, in which two hydrogen atoms are replaced by a methyl and ethyl group; present in bone oil. The 1, 3, 5-collidine is found in coal tar. Bpt. 172° C.

Collie. Scotch sheep-dog with very bare legs, long bushy tail, and thick coat of woolly hair forming a ruff round the



Collie.

neck. The breed has been crossed with the black-and-tan setter for the sake of improving his color as a house-dog. There is also a smooth-coated collie.

Collier, ARTHUR, 1680–1732. English metaphysician and divine, noted for his theory of idealism, identical with that of Berkeley, but worked out independently. *Clavis Universalis*, 1713.

Collier, JEREMY, 1650–1726. English nonjuring bishop 1713; author of a book against the stage, 1697, which had much effect, and an *Eccl. Hist. of Gt. Britain*, 1708–14.

Collier, JOHN PAYNE, 1789–1883. English commentator on Shakespeare. *Hist. English Dramatic Poetry*, 1831.

Collier, PETER FENELON, b. 1849 in Ireland. N.Y. publisher of *Collier's Weekly*, formerly *Once a Week*. First to sell bound books on the installment plan.

Colligati. Feet of birds with grallatory legs, having three toes directed anteriorly, united by a short web, and one toe posterior.

Collimating Eyepiece. For use in testing the adjust-

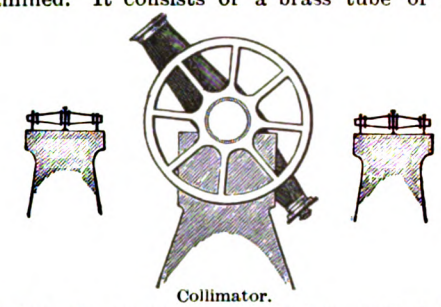
ment of the line of collimation of the transit instrument. It is provided with a reflector for throwing the light from a lamp upon the threads, to render them visible. The instrument is pointed to a basin of mercury placed below, the telescope being vertical. The direct image of the threads may then be seen together with that reflected from the mercury; if the adjustment is perfect the two will coincide.

Collimating Telescope. Placed horizontally in front of the transit instrument, so that when the telescope of the latter is horizontal it looks into the object glass of the former. A thread placed in the principal focus is then seen as though viewed from an infinite distance, and forms a sharp definite mark for testing the adjustment of the collimation line.

Collimation, Error of. Deviation from perpendicularity of the line of collimation of the transit telescope to the axis of revolution.

Collimation, Line of. Line joining the optical center of the object glass of a telescope with the middle thread of the reticule near the eyepiece.

Collimator. Essential part of a spectroscope or spectrometer for rendering parallel the rays of the beam of radiation to be examined. It consists of a brass tube of adjustable



Collimator.

length, having at one end a convex lens and at the other a small adjustable opening, usually a slit. The slit is placed at the principal focus of the lens.

Collimator of Spectroscope. Telescope placed with its object glass toward the prism or grating, and having at its principal focus a slit to admit the light of the body to be investigated.

Collin d'Harleville, Jean Francois, 1755–1806. French dramatist.

Colling, Charles, 1751–1836. English agriculturist and breeder of live stock. In connection with his brother Robert he applied the principles, so successfully used by Bakewell in the improvement of the Leicester sheep, to the improvement of Shorthorn cattle to such an extent that they may be said to have originated the breed.

Collingwood, Cuthbert, Lord, 1750–1810. British admiral; associated with Nelson; second in command at Trafalgar Oct. 1805, and made a Baron for the victory.

Collingwood, Francis, b. 1834. Engineer of Newport News dry dock; sec. American Society of Civil Engineers since 1891.

Collins, Anthony, 1676–1729. English deist. *On Free-thinking*, 1713; *Grounds and Reasons of the Christian Religion*, 1724.

Collins, Mortimer, 1827–1876. English novelist, poet, and essayist. *Long Life*, 1871.

Collins, William, 1721–1759. English lyric poet. His *Odes*, 1747, neglected at the time, are highly valued, especially that on *The Passions*. He died in an insane asylum.

Collins, William Wilkie, 1824–1889. English novelist, noted for the intricacy of his plots; son of Wm. the painter (1788–1847). *Antonina*, 1850; *Basil*, 1852; *After Dark*, 1856; *Dead Secret*, 1857; *Woman in White*, 1860; *Armadale*, 1866; *No Name*, 1871; *Moonstone*, 1872; *Black Robe*, 1881; also two plays, *Lighthouse* and *Frozen Deep*.

Collinson, Peter, 1694-1768. English botanist, who introduced many foreign plants into America.

Collodion. Solution of gun cotton in a mixture of sulphuric ether and alcohol, largely used in photography, and in medicine to protect small wounds, chafes, etc. Combined with a small amount of castor oil, it becomes flexible and better adapted to medical uses. See Nitro-cellulose.

Colloid. If a number of substances be arranged in a series according to their relative diffusibilities, we find at one end of the list a number of substances of slow diffusibility, such as starch and albumen, which have in general an amorphous, glue-like character; these are colloids. Substances at the other end of the list, of rapid diffusibility, such as urea and chloride of sodium, are called crystalloids. The former will not diffuse through vegetable or animal membranes.

Colloid Cancer. Variety of cancer in which, after degeneration has taken place, there are numerous collections of glue-like material.

Collot d'Herbois, Jean Marie, 1750–1796. French terrorist, author of many executions at Lyons 1793; deported to Cayenne 1795.

Collozoa (Polycyttaria). Family of *Radiolaria* including usually compound forms without skeleton (*Collozoum*) or with isolated spicules (*Sphærozoum*), or a simple foraminated shell (*Collosphæra*).

Collozoum. Genus of *Polycyttaria*. These forms have a gelatinous or protoplasmic matrix, nearly spherical, with no skeleton, but many central capsules imbedded in it.

Collum. Narrowed base of the sporange in mosses.

Collyer, Robert, b. 1823 in England. Originally a blacksmith, then a Methodist preacher; Unitarian pastor in Chicago 1859–79, and since in N. Y. *Nature and Life*, 1866.

Collyer, William Bengo, D.D., 1782–1854. English Cong. divine and hymnist.

Colman, George, 1733–1794. English dramatist and manager. His son and namesake, 1762–1836, succeeded him in both capacities. *Recollections*, 1830.

Colman, Samuel, b. 1832. American painter and engraver. He has reproduced on copper many of his sketches made in Spain, Italy and Algiers. His style is broad and free, and he has a fine sense of the picturesque. *Mexican Hacienda; Mt. Tacoma from Puget Sound; Grand Canyon of the Colorado.*

Colmar, or **Kolmar.** Ancient town of Alsace; free city of the empire 1226; fortified 1552, dismantled 1673; annexed to France 1697, to Germany 1871. Pop., 1890, 30,411.

Colocynth. *Citrullus colocynthis.* Trailing vine of the Gourd family, native of the Mediterranean region, but widely distributed in warm countries. The fruit is used in medicine as a purgative, and is poisonous.

Cologne. City of Prussia, on left bank of the Rhine; founded by the Ubii ab. 37 B.C.; named from a Roman colony planted A.D. 50. It became a part of the German empire 870; entered the league of the Hanse towns 1201, and had an extensive commerce. The Church of St. Ursula is said to contain the bones of the 11,000 virgins; and that of St. Gereon those of the 308 martyrs of the Theban legion. Pop., 1890, 281,273.

Cologne Cathedral. Founded ab. 814, burned 1248. The present structure, begun 1248, remained in an unfinished state

Cologne Cathedral.

from 1509 till 1823; the foundation of the new part was laid 1842; the main body of the church was opened 1848, and by 1863 all was completed except the western spires, which were

finished 1880. These rise 515 feet from the floor of the nave. The body of the church measures 440 by 240 ft. The bones of the three Magi were bestowed on this church by Frederic Barbarossa 1162.

Cologne School of Painting. Early 15th century German art had here its finest development, due to influences of the Van Eycks in the Netherlands. Leading artists, Master William and Master Stephen. By the latter is the *Kölner Dom Bild*, in the Cathedral choir, the most beautiful of early German paintings.

Cologne Spirits. Best quality of ordinary alcohol, refined with special care, and containing ab. 94 per cent of ethyl alcohol and 6 per cent of water.

Colombia, UNITED STATES OF. Republic in n. w. portion of South America. The w. part is traversed by the Andes, leaving along the w. coast and in the n. small areas of lowland. E. of the Andes are plains stretching toward the llanos of the Orinoco. The country is covered with forests of valuable tropic woods. Agriculture is rudely practiced, and some cotton, sugar, coffee, indigo, etc., are produced. The country abounds in undeveloped mineral wealth. The area is ab. 514,000 sq. miles; the capital is Bogota. The coast was traced 1499–1500. By 1536 the natives were mostly subdued and Spanish government established. After long connection with Peru, the viceroyalty of New Granada was formed 1740. Independence was declared 1810 and secured 1819 under Bolivar, in union with Venezuela and Ecuador; these states withdrew 1831, and the country was called New Granada. The present name was assumed 1861, and a new constitution adopted 1886. Pop. ab. 4,000,000.

Colombo. Capital and principal seaport of Ceylon, on w. coast; fortified by the Portuguese 1517. It was taken by the Dutch 1603, and by the British 1796. Pop., 1891, 126,926, of various nations.

Colon. Large intestine, or that portion into which the small intestine opens and which extends up on the right side from the pelvis to the under surface of the liver, from which point it crosses the abdomen to the right side to descend again into the pelvis, where it becomes the rectum.

Colon. See COLUMBUS.

Colonel. Commander of a regiment, below a brigadier-general and above lt.-col. in rank in the U. S. army.

Colonial Congress. See CONGRESS, COLONIAL.

Colonies. In Palæontology, temporary occupation of an area by a fauna belonging either to an adjoining area or to a slightly higher or lower horizon.

Colonies, AMERICAN. See UNITED STATES.

Colonies, GRECIAN. Founded in nearly all parts of the Mediterranean and to the n.e. as far as the sea of Azov, attesting the energy and enterprise of the Greek race. They were as a rule independent politically of the mother cities, though owning a filial relation.

The Æolian, in n. w. part of Asia Minor, were the result of a migratory movement from Bœotia, following the course of the expedition against Troy. Besides 12 cities on the mainland, they occupied Tenedos, Lesbos, Sestus in the Chersonese, and Ænus in Thrace.

The Ionian were thought to have been founded later. Ionians, driven from n. Peloponnesus by Achæans, found Attica too narrow for them, and began to occupy the islands to the e. Between 1000 and 800 B.C. settlements were made on the Asiatic coat and islands, and an association of 12 cities was organized, embracing Miletus, Phocæa, and Samos. By 780 Miletus began to send out colonies to the Propontis and the Euxine.

The Dorian issued from Peloponnesus during the Dorian conquest of the peninsula. They took possession of the s. Cyclades, Rhodes, Cos, with other islands, and a section of the adjoining mainland.

These 3 groups of colonies were reduced by the kings of Lydia between 700 and 565 B.C., the Æolian group retaining their independence till the time of Crœsus. In the two latter groups there was a considerable admixture of other races.

The n. shores of the Ægæan, both sides of the Propontis, nearly the whole circuit of the Euxine, the coast of Illyria, the e. and s. sides of Sicily, the border of Libya, and s. Italy, were dotted with Greek settlements, some of which became powerful states. Even Spain, Gaul, and Africa had some Greek towns: Marseilles was settled from Phocæa ab. 600 B.C.; Cyrene in Libya ab. 630 from Thera, and became in turn a mother-city. In Sicily Syracuse owed her foundation to Corinth ab. 735 B.C.; she founded Camarina 601 and maintained her independence more than 500 years.

Gela was colonized from Rhodes 690, and founded Agrigentum 582. Chalcis in Eubœa founded Naxos in Sicily 736; Naxos established Leontini 730, and Catana a few years later. Magna Græcia, or s. Italy, had great attractions for the adventurous Greeks. Sybaris and Crotona were Achæan colonies; Cumæ and Rhegium were daughters of Chalcis; Tarentum was Spartan, and Thurii was Athenian. The abounding vitality of the Hellenic stock produced that cordon of little republics which completely ringed the Midland Sea, save where Phœnician and Etruscan civilization had preoccupied the ground. The Athenians sometimes sent out colonies called *cleruchies*, which remained in close or in laxer political relation with Athens. In such cases the State provided arms and defrayed expenses of journey, and the colonists retained their Athenian citizenship.

Colonies, ROMAN. These were always established by, and remained a part of, the parent state; were intended to check conquered races, to repress hostile incursions, to provide for veteran soldiers, or to relieve Rome of turbulent characters. The earlier colonies were of the nature of garrisons, only volunteers joined them; colonists retained their rights of Roman citizenship. By these means the empire was consolidated, decay of population checked, and the unity of the nation and of the language promoted.

Colonization. Transfer of population to unoccupied or thinly settled countries, in order to diminish the numbers at home, found new centers of national life, or raise the condition of the colonists.

Colonna. Roman family, known from ab. 1100. They were Ghibellines and rivals of the Orsini. Giovanni became cardinal 1216, and joined the Fifth Crusade. His nephew Giovanni, Abp. of Messina 1255, wrote a History of the World. Cardinal Giacomo was councilor under Nicholas IV. Sciarra, one of the chiefs of the conspiracy against Boniface VIII., 1303, d. in exile ab. 1328. His brother Stephen, Count of Romagna ab. 1290, became chief of the Guelphs at Rome, and was killed in the conflict with Rienzi ab. 1350. Otho was elected Pope (Martin V.) 1417. His nephew Antonio became Prince of Salerno and Duke of Amalfi 1419. Eugene IV. declared war against Antonio and his brothers, who had seized the treasures of Martin V. Prosper, son of Antonio, fought for Charles VIII. and for Ferdinand of Spain, took Milan 1521, and d. 1523.

Colonna, VITTORIA, 1490–1547. Italian poet, noted for her friendship with Michelangelo; daughter of the Constable of

Vittoria Colonna.

Naples, m. 1507 to Marquese di Pescara, who d. 1525. *Rime Spirituali*, 1548.

Colonnade. In classical architecture colonnade corresponds to the Gothic ARCADE (q.v.), having an entablature instead of arches.

Colophonium, or COLOPHONY. Resin obtained from certain varieties of pine; called rosin. It consists largely of abietic acid, and is the resinous matter left after the turpentine has been removed, by distillation, from the exudation from the pine. See ABIETIC ACID.

Color. Characteristic effect of light dependent upon the wave length. Sunlight is composed of rays of many different colors varying from the red, which has the longest wave length, to the violet, which has the shortest. The color of objects is directly dependent upon the kind of light that they reflect or transmit to the eye. Subjectively, it is a sensation arising from stimulation of the optic nerve by light radiated from a luminous body or reflected from a non-luminous body or by some mechanical stimulus, *e.g.*, pressure on eyeball. Objectively, it is the quality producing such sensation. A ray of

white light analyzed into parts of definite wave lengths shows the colors, red, orange, yellow, green, blue, indigo and violet. (See SPECTRUM.) These colors are termed primary. Psychologically, black and white are also to be regarded as colors. Colors vary, in hue, according to the wave length of the light, in brightness, and in chroma or the amount of white light entering into them. A color is said to be saturated when it is free from admixture of white light.

Color. In mining, any small speck of gold seen in a pan after washing a sample of sand or gravel.

Colorado. One of the Western States. In shape it is nearly rectangular, being limited by parallels and meridians. Its area is 103,925 sq. m. The e. part consists of rolling plains, sloping gently eastward. The central portion is a high and intricate mountain region, containing many ranges exceeding 14,000 ft. in height. The w. portion is a region of plateaus, descending toward the basin of the C. The industries are agriculture, cattle, and sheep raising and mining. Of silver it is the largest producer in the U. S. Its annual production of the precious metals is ab. $36,000,000. Large quantities of coal are mined, the principal areas of production being along the e. base of the mountains. The region was explored by Gen. Fremont 1843, but it was not until the discovery of gold in 1858 that immigration began. The territory was organized 1861 from portions of Utah, Kansas, Nebraska, and New Mexico. In 1864 it was the seat of an Indian war. Since 1865 the growth has been continuous and rapid. It was admitted as a State in 1877; the capital is Denver. Pop., 1890, 412,198. (See Map on page 332.)

Colorado Chiquito, or LITTLE COLORADO. Left hand branch of the C., in n.e. Arizona. Length ab. 225 m.; drainage area 29,268 sq. m.

Colorado College. At C. Springs, was chartered 1873, reorganized 1888. It has 16 instructors.

Coloradoite. HgTe. Rare mercuric telluride, found in a few mines in Col.

Colorado Potato Bug. See POTATO BEETLE.

Colorado Range. In Col. It rises from the plains to an altitude of 13,000 to 14,300 ft., containing many of the highest peaks of the Rocky Mt. system. The material is granite, with stratified beds forming its e. foothills.

Colorado River. Formed by the junction of two main branches, the Grand and Green, in e. Utah. The former rises in Middle Park, Col., and flows generally s. w. The Green, which is the larger, rises in the Wind R. Mts. in w. Wyoming, and flows generally s. From their junction the C. flows s.w., then w., and finally s. to its mouth at the head of the Gulf of Cal. Its flow is small compared to its drainage area of 255,000 sq. m., almost entirely in an extremely arid region of plateaus, in which the main stream and most of its branches have cut canyons; some of these are of great depth, reaching in the Grand Canyon 7,000 ft. Length 1,200 m. It is navigable for 100 m. above its mouth.

Colorado River. In Texas. It heads in the edge of the Staked Plains, and flows s.e. Length 850 m., drainage area 41,220 sq. m.

Colorados. Red ores: equivalent of gossan, especially when colored with ferric oxide.

Colorado Springs. Capital of El Paso co., Col., at foot of Pike's Peak; prominent as a health resort. Pop., 1891, 11,140.

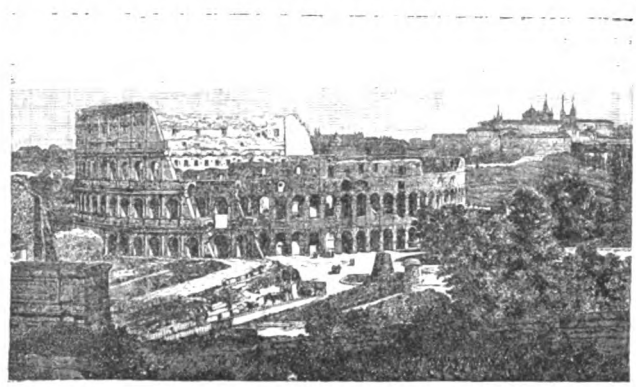
Colorado, UNIVERSITY OF. Founded by the State 1876 at Boulder, Col. It has departments of law and medicine, 66 professors and lecturers, and ab. 300 students, including those of the preparatory school.

Color Blindness. Inability to perceive colors as such. It may be total or partial, and is independent of the other visual functions. It shows itself commonly in a tendency to confound one color with another, as blue with green, or in an inability to perceive a particular color (most commonly red), which is then ordinarily confused with gray or green. It is variously estimated to exist in from 3 to 6 per cent of the population, and is much more frequent in men than in women.

Colors. Garrison flag, hoisted at military posts from reveille till sunset, is the national color or U. S. Flag. It is made of bunting, 36 ft. fly and 20 ft. hoist, with 13 horizontal stripes of equal breadth, alternately red and white, beginning with the red. In the upper quarter, next the staff, is the Union, composed of a number of white stars, equal to the number of States, on a blue field, one-third the length of the flag, and extending to the lower edge of the fourth red stripe from the top. The post flag is similar, but with 20 ft. fly and 10 ft. hoist; the storm flag is 8 ft. fly and 4 ft. 2 in. hoist.

Color Top. Apparatus consisting of a spindle which can be rapidly rotated by means of a pulley driven by a band from the driving wheel of some motor. Its purpose is to produce a succession of color impressions upon the retina so rapid as to cause the sensation to be that of a single resultant tint. A graduated circle is fixed to the spindle; disks of colored paper slit from the center outward may be placed against the disk, and by the graduations the relative amounts of color exposed may be read off. By this means the effect of the mixture of different colors in different proportions may be studied.

Colosseum. Ruins of the Flavian amphitheater at Rome, begun by Vespasian, consecrated by Titus 80, and finished by



Colosseum.

Domitian; elliptical in form; 620 ft. long by 513 broad, and 160 high. It could seat 87,000 spectators. See AMPHITHEATER.

Colossians, EPISTLE TO THE. Twelfth N. T. book, written by Paul in his Roman prison, ab. 62, to the Ch. of Colossæ in Asia Minor, against a fantastic angelology, which threatened to lose Christ out of sight.

Colossochelys. Huge Pliocene tortoise whose carapace is 6 ft. long; found in the Civâlik hills of British India.

Colossus of Rhodes. Gigantic brass image of the sun, placed near the entrance of the harbor of Rhodes ab. 280 B.C.; destroyed by an earthquake ab. 224 B.C.; mythically represented as standing on two moles, with a leg on either side of the harbor.

Colotomy. Opening into the colon, usually performed through the loin, but occasionally in the groin or middle line; commonly done in cases where the bowel is obstructed beyond the point of operation. As a rule the opening is maintained and the fæces voided through it.

Colquhoun, ARCHIBALD ROSS, b. 1846. British traveler in s. China. *Across Chrysé*, 1885.

Colquhoun, JOHN, 1805–1885. Scottish writter on angling. *Moor and Loch*, 1840–84; *Rocks and Rivers*, 1849; *Sporting Days*, 1866.

Colquhoun, PATRICK. 1745–1820. Scottish magistrate and writer. *Police*. 1795; *Resources of British Empire*. 1814.—His grandson, SIR PATRICK, b. 1815, pub. *Roman Civil Law*, 4 vols., 1849–60.

Colt, SAMUEL, 1814–1862. Inventor of the revolving pistol 1835; manufacturer at Hartford, Conn.

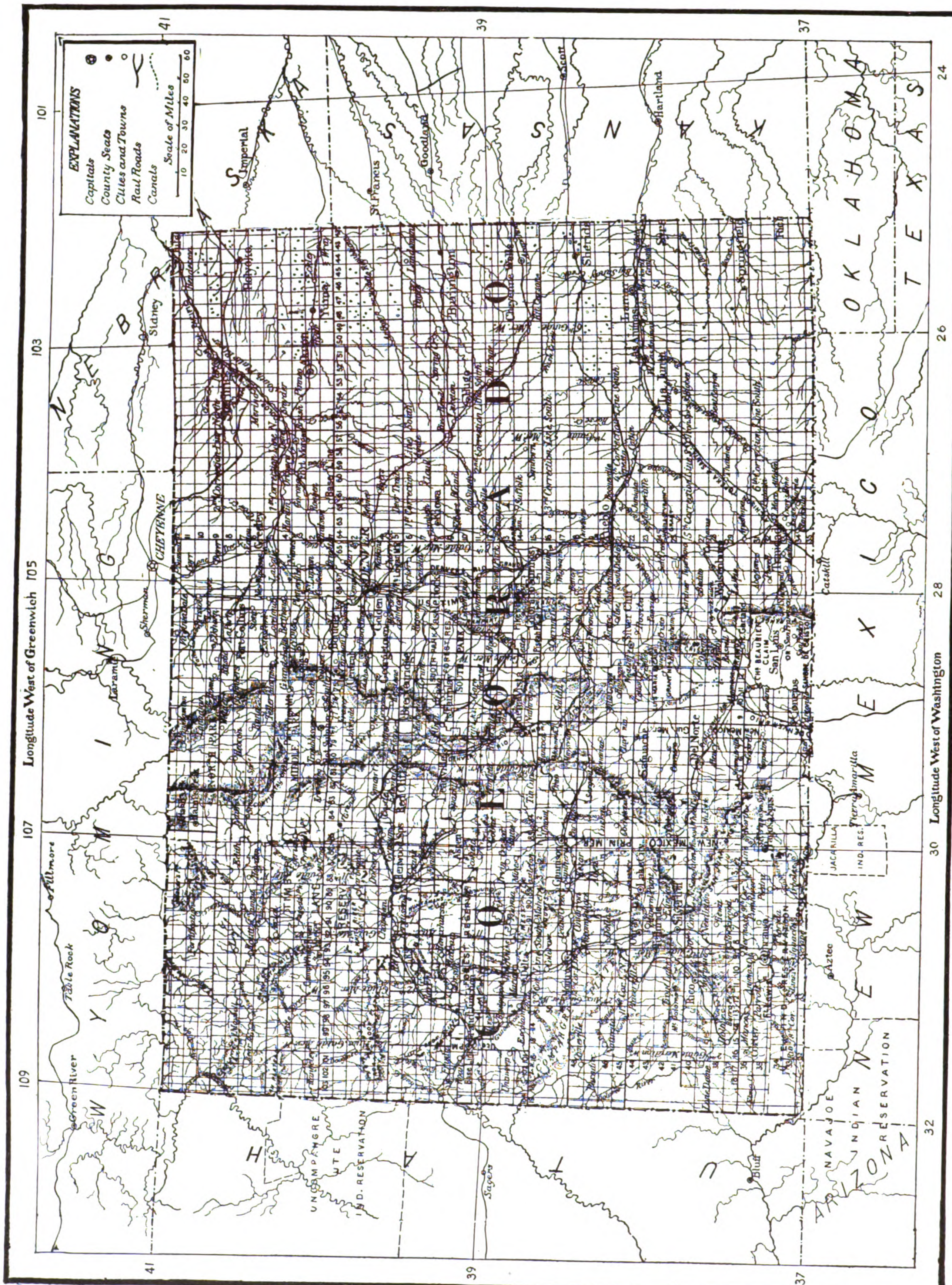
Colton, CALEB CHARLES, 1780–1832. English poet and maker of apothegms. His *Lacon*, 1820–22, was highly esteemed. Though author of moral maxims, he was a gambler and suicide.

Colton, CALVIN, 1789–1857. American journalist; prof. Trinity Col. 1852; biographer of Henry Clay, 1846–56, and a prolific writer.—His brother, WALTER, 1797–1851, long chaplain U. S. Navy, wrote *Ship and Shore*, 1835, and *Deck and Port*, 1850.

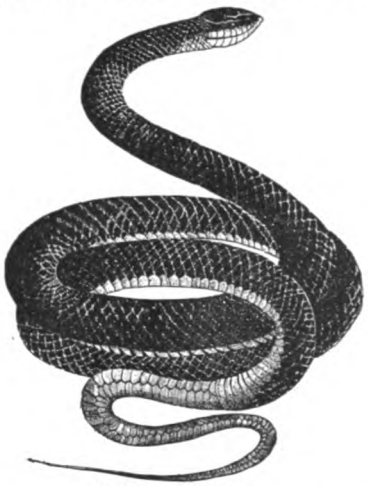
Coltsfoot. *Tussilago farfara*. Officinal herb of the Composite family, native of Europe, introduced into N. America.

Coltsfoot, SWEET. *Nardosmia palmata*. Herb of the Composite family, native of n. N. America.

Colubridæ. Family of harmless snakes, including many species, widely distributed, among which are *Bascanion constrictor*, the Black Snake, which has smooth scales; another species of this genus has keeled scales, and is the Mountain Black Snake; the former is pugnacious, the latter gentle. It may attain a length of 7 ft. The *Spilotes* of the Southern States is black with a yellow throat, and attains the length of 10 ft. The Coachwhip Snake, also of the South, is noted for


EXPLANATIONS
Capitals
County Seats
Cities and Towns
Rail Roads
Canals
Scale of Miles
10 20 30 40 50 60
Longitude West of Greenwich
Longitude West of Washington
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
NEW MEXICO
ARIZONA
UTAH
WYOMING
COLORADO
CHEYENNE
UNCOMPAHGRE UTE IND. RESERVATION
NAVAJOE INDIAN RESERVATION
JACARILLA IND. RES.
Sidney
Imperial
St. Francis
Goodland
Hartland
Laramie
Sherman
Allmore
Table Rock
Green River
Sagers
Bluff
Aztec
Tierra Amarilla
Catskill
Denver
Pueblo
Del Norte
San Luis
Rico

its great speed, resembles a braided whiplash, and grows to a length of 6 ft. Of similar size is the Pine Snake, s. of the Ohio. The Corn Snake of the South robs hen-roosts at night. These



Coluber constrictor.

are generally harmless, but the Rat Snake of India, which is 7 ft. long, enters houses and assumes the aggressive while the Gray Snake of Jamaica strikes for the eyes when irritated.

Colubriformia. Sub-order of *Ophidia*, including harmless snakes, characterized by solid, recurved teeth in both jaws and on the palatines and pterygoids. In a few (*Opisthoglypha*) genera the posterior, mandibular teeth are grooved and connected with poison glands, but the bite is not dangerous. Examples are: *Uropeltidæ*, with short pointed head, and nondistensible mouth, mainly in the E. Indian region; *Tortricidæ*, tropical snakes, with short tails, burrowing in the sand, eating insects, and having rudiments of hind limbs (anal claws); *Erycidæ*, Sand Snakes, also tropical, with pelvic rudiments, feeding mainly on mice; and the *Coronellidæ*, represented by the Puff Adder or Hognose, which flattens itself threateningly, but is harmless. The *Rachiodontidæ* of Africa are remarkable in having almost no teeth in the jaws, but the ventral processes of some of the cervical vertebræ project as teeth into the œsophagus. These snakes live on eggs, which are cut open in the gullet, the contents swallowed, and the shell rejected. The *Achrochordidæ*, Wart Snakes, with tuberculate scales, are viviparous. For the tropical members of this group see COLUBRIDÆ. Other colubriform snakes are the Pythons and Boas (see PERODA), various families of TREE SNAKES (q.v.) (*Dendrophidæ*, *Dryophidæ*, *Dipsadidæ*) and WATER SNAKES (q.v.) (*Natricidæ*, *Homalopsidæ*).

Colubus. See SEMNOPITHECIDÆ.

Columba, ST., 521–597. Irish missionary to Scotland 563, where he founded an abbey on Iona Is., and converted the Picts.

Columbæ, or COLUMBACEI. See COLUMBINÆ.

Columban, ST., ab. 543–615. Irish monk, founder of monasteries in wild parts of s. e. France, and, when driven thence, at Bobbio in Italy. His aims and results were civilizing and ennobling.

Columbarium. Roman burial chamber, sometimes constructed above ground, sometimes excavated. It was allotted to the humbler burials, and had a series of niches for the urns containing the ashes of the dead; named from the resemblance to a pigeon house.

Columbia. Capital of S. Carolina, on the Congaree, below the junction of Broad and Saluda rivers; seat of the State university; taken by Union forces under Sherman Feb. 17, 1865. Pop., 1890, 15,353.

Columbia. Borough of Lancaster co., Pa., on the Susquehanna. Pop., 1890, 10,599.

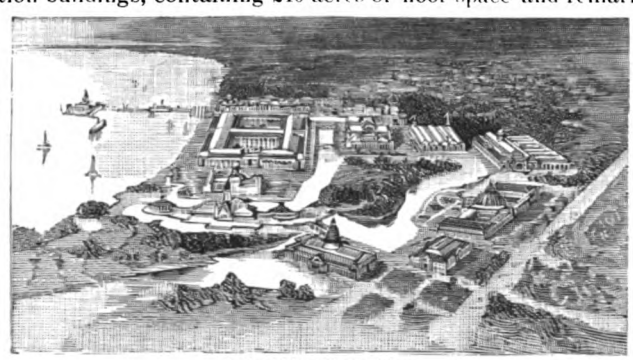
Columbia, BRITISH. Province of Canada bordering on the Pacific; organized 1871. It includes Vancouver's Island, and embraces an area of 382,300 sq. m. It owes its importance to gold mines, which began to be opened 1856. These regions prove to be widely extended, covering an area of not less than 200 sq. m. The influx of lawless adventurers made necessary some regularly organized government, and since its organization the territory has begun to receive a permanent population, a portion of which is engaged in agriculture and fisheries. Capital, Victoria. Pop., 1891, 98,173.

Columbia College. In N. Y. city, chartered 1754 as King's College; made a military hospital 1776; reorganized 1784. Instruction in law has been given since 1793; the Law School was established 1858; the School of Mines 1864; that of Political Science 1880; that of Philosophy 1890; that of Pure Science 1892. A medical faculty was formed 1767, but discontinued 1813; in 1891 the College of Physicians and Surgeons became the medical department of the College. The institution was reorganized as a university 1890–91. In the six faculties there are 82 professors and 89 other instructors. There are (1895) 264 students in arts, 285 in law, 786 in medicine, 397 in the school of mines, 170 in political science, 171 in philosophy, and 66 in pure science. The yearly income is $650,000. The library contains nearly 200,000 vols.

Columbiad. Sea coast, chambered smooth-bore gun, designed to fire solid shot or shell. It combines certain qualities of the gun, howitzer and mortar; it was invented by Col. Bomford, and used in the war of 1812 for firing solid shot; in 1844 the model was changed, by lengthening the bore and increasing the weight of metal, so as to increase the charge of powder to one-sixth that of the shot; in 1858 they were used as shell guns only, to be fired with diminished charges. Rodman's model of 1860, of calibers 8″, 10″ and finally 15″ entirely superseded the old chambered guns.

Columbia, DISTRICT OF. Federal district of the U. S., comprising its seat of government; on left bank of the Potomac, within the limits of Md.; area 64 sq. m. Till 1846 it included Alexandria and 36 sq. m. of Va. The surface consists mainly of a plateau 200 to 400 ft. above the river, with a considerable extent of bottom land just above the mouth of the Anacostia. On this bottom land the City of WASHINGTON (q. v.) is built. Georgetown, the other city in the district, is immediately above Washington, where the bluffs close in on the river. The Potomac is navigable to Georgetown, and the cities have some commerce, mainly exports of coal and lumber and imports of ice. The trade and manufactures are not large. The charters of Washington and Georgetown were revoked 1874 and the entire district placed under one government, at the head of which are three commissioners appointed by the President. Pop., 1890, 230,392, ab. one-third colored.

Columbian Exposition, or WORLD'S FAIR. Held at Chicago 1893 to celebrate the quarto-centenary of the landing of Columbus. The great discoverer was represented by a lineal descendant, the Duke of Veragua, who attended as the guest of the nation. About fifty foreign governments accepted the President's invitation to exhibit, and appropriated $5,846,664; the various States of the Union also contributed $6,020,850 for their individual exhibits. The enormous Exposition buildings, containing 240 acres of floor space and remark-



Columbian Exposition.

able for their beauty and architectural unity, were erected in Jackson Park, a tract of 666 acres s. e. of Chicago with a lake frontage of ab. 1½ m. The grounds and buildings cost $18,322,622 and operating expenses $7,127,240. They were dedicated with imposing ceremonies Oct. 11, 12, and 13, 1892. The Exposition proper opened May 1, and closed Oct. 31, 1893, the visitors numbering 27,529,400 and the exhibitors 65,422. Of special interest among the memorials of Columbus were exact reproductions of his caravels, the *Santa Maria*, *Nina* and *Pinta*, and the convent of Santa Maria de la Rabida. Total receipts $33,290,065.58: expenses $31,117,353.79.

Columbian University. In Washington, D. C., incorporated 1821 as Columbian College; name changed 1873; new building erected 1883. The Corcoran Scientific School was added 1884, and a school of graduate studies 1892. In 1893–94 it had a staff of 117 instructors, 298 students in arts and sciences, 328 in law, 150 in medicine, 44 in dentistry, 24 in the graduate school, and 85 in the preparatory—total 929.

Columbia River. Formed by the union of Clark's Fork and Snake R., which rise in the Rocky Mountains, in British Columbia, Montana, and Wyoming. The former, collecting its abundant streams, pursues a circuitous course into Washington. The latter flows w. across Idaho, n. between Idaho and

Oregon, and thence w. in s. Washington to the junction. Thence the combined stream flows w. through the Cascade and Coast ranges to the Pacific, forming most of the boundary between Wash. and Or. Length ab. 1,400 m., drainage area 216,537 sq. m. It is navigable for 140 m.

Columbinæ (COLUMBÆ, COLUMBACEI, GYRANTES, PERISTEROMORPHÆ, or GEMITORES). Order of birds, including the pigeons; sometimes included with the *Gallinacei* in the group *Rasores*. They have a weak soft beak, swollen around the nasal apertures, pointed wings, short toes, the hinder on a level with the others. The sexes are nearly similar in feather. The crop in both sexes secretes a creamy fluid for the young, which are altrices. They are gregarious but monogamous, widely spread, living in forests, and laying usually two eggs in a rude nest. The domestic pigeons are descended from the Rock-dove (*Columba livia*) of the Mediterranean region. See also DODO.

Columbine. Showy-flowered plants of the genus *Aquilegia*, natural family *Ranunculaceæ*, natives of the n. hemisphere.

Columbite. $FeCb_2(Ta_2)O_6$. Mineral containing the rare element columbium, combined with iron and manganese; found in U. S. See TANTALITE.

Columbium, or NIOBIUM. Cb. At. wt. 93.25, sp. gr. 4.06. Discovered by Blomstrand 1865. It occurs in the mineral columbite, and is prepared by heating the chloride with hydrogen. It is very rare; its compounds are not well known.

Columbo, AMERICAN. *Frasera carolinensis.* Plant of the Gentian family, native of the s. U. S.

Columbus. Capital of Muscogee co., Ga., on the Chattahoochee. Pop., 1890, 17,303.

Columbus. Capital of Ohio, in Franklin co., on Scioto R., near the center of the State; seat of the State Univ. and of Capitol Univ. It is regularly laid out, with broad streets, of which 80 m. are paved, and is supplied with water by pumping from Scioto R. It has 14 railroads and extensive manufactures. Pop., 1890, 88,150.

Columbus, CHRISTOPHER, 1446–1506. B. at Genoa; discoverer of the Western World. He cherished the belief that the e. shores of Asia could be reached by sailing westward. After years of disappointment and ridicule he succeeded in interesting Ferdinand and Isabella of Spain. Aug. 3, 1492, he sailed with three ships from Palos. Oct. 12 he was rewarded

Christopher Columbus.

with the sight of land, which proved to be one of the Bahamas, he named it San Salvador. After discovering Cuba, San Domingo, and several other of the West India islands, he returned to Spain, where honors and privileges were conferred upon him. In Sept. 1493 he set out on another expedition, during which he discovered Jamaica, the Caribees, and other islands. On a third voyage, 1498, he discovered Trinidad and the mouths of the Orinoco. His fourth voyage, 1502–4, was disastrous. From the first moment of triumph he contended with calumnies and ingratitude; he died in poverty and disappointment at Valladolid.—His elder brother, BARTHOLOMEW, 1432–1514, was Lieut.-gov. of the W. Indies.—Another brother, DIEGO, bore a share in these labors.

Columbus, DIEGO, ab. 1480–1526. Eldest son of Christopher; admiral and gov. of Hispaniola 1509–23.—His brother, FERDINAND, 1488–1539, wrote a Life of the discoverer, extant in an Italian version of 1571.—Diego's son, LUIS, ab. 1521–1572, Duke of Veragua, Marquis of Jamaica, and gov. of Hispaniola 1542–51; was banished to Africa 1563 for bigamy. The male line became extinct with his nephew 1578.

Columella. Central prolongation of a vegetable axis through a sporange or sporocarp or fruit, as in the sporanges of mosses, etc.

Columella. Central pillar at the base of the calycle in corals; central pillar of univalve shells; also a bone uniting the parietal with the pterygoid bone in reptiles.

Columella, LUCIUS JUNIUS MODERATUS, 1st century. Latin writer on agriculture.

Columella Auris. Bone uniting the tympanum to the fenestra ovalis of the ear in amphibia, reptiles, and birds.

Columelliaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, containing one genus and two species, confined to the Andes.

Column. Arrangement of the geological formations, as a final result of the correlation of geological work in all parts of the world where investigations have been followed out. To some extent different terms are still in use in different countries, but as the study advances, especially in palæontology (where the rocks are fossiliferous), a gradual uniformity comes in. As a rule, the terms are introduced by the country whose geologists lead in the study of the horizon to which they apply. As now arranged the geological column is as follows:

SYSTEMS.	
Quaternary	Pleistocene.
Tertiary, or *Cænozoic*	Pliocene, Miocene, Eocene.
Secondary, or *Mesozoic*	Cretaceous, Jurassic, Triassic.
Palæozoic	Carboniferous, Devonian, Silurian, Ordovician or Lower Silurian, Cambrian.
Algonkian	Keweenawan, Huronian.
Archæan	Laurentian.

For details and subdivisions see under separate terms.

Column. Detailed vertical support, originally of masonry, consisting of a base, shaft, and capital. See ARCHITECTURE.

Column. Bar or prism which is longer than about ten times its least diameter, and subject to compression. Let P be the load which produces compression, and A the area of the cross-section of the column: then the mean unit-stress is $P \div A$, but the actual maximum unit-stress is greater than this, and rapidly increases with the length of the column. A column with fixed ends is four times as strong as one with ends simply hinged.

Column. That formation of troops in which they are drawn up with a depth of several ranks; in distinction to formation in line. A regiment in line may be ployed into a column of battalions; a battalion into a column of companies or of lesser subdivision. The front of a regimental column is less as the depth increases; close column is that formation where the subdivisions are at a less distance than the width of their front, and open column, when at an equal distance.

Colure, EQUINOCTIAL. Great circle of the celestial sphere, perpendicular to the equator and passing through the equinoxes.

Colure, SOLSTITIAL. Great circle of the celestial sphere, perpendicular to the equator and passing through the solstices.

Colvin, SYDNEY, b. 1845. English biographer of Landor and

Keats 1881–87; associate and successor of Leslie Stephen in editing *Dict. National Biography*.

Colza. *Brassica campestris.* Herb of the Mustard family, native of Europe; cultivated for its seeds, from which Colza Oil is expressed; this is used for illumination.

Coma. Tuft of hairs borne at the ends of the seeds of certain plants.

Coma. Complete loss of consciousness, due to disease, or injury to or compression of the brain, or certain drugs; *e.g.*, opium. Stupor caused by alcohol is a familiar example.

Comatulidæ (FEATHER-STARS). Crinoids which are free and unstalked when adult. The stalked condition has been named *Phytocrinus*. *Antedon* is typical.

Comb. Peculiar structure in some mineral veins, produced by an arrangement of the ore in sheets, parallel to the walls of the vein.

Combat. Minor engagement, or one between two bodies of troops not sufficiently large to be called armies.

Combe, GEORGE, 1788–1858. Founder of English phrenology after the principles of Spurzheim and Gall: author of *The Constitution of Man*, 1828.—His brother, ANDREW, M.D., 1797–1847, wrote much on physiology.

Combe, WILLIAM, 1741–1823. English humorist. *Dr. Syntax*, 1812–21.

Combermere, STAPLETON COTTON, 1773–1865. English General; Baronet 1809, Baron 1814, Commander in India 1825–30, Viscount 1827, Field-marshal 1855.

Combes, CHARLES PIERRE MATHIEU, 1801–1872. Director of the School of Mines and member of the Academy of Science, Paris. Inventor of the Combes or so-called Casella air meter for measuring the velocity of winds and currents. His treatise on Mining, 3 v., 1844–46, was long a standard for reference.

Combinational Tone. Produced when two musical notes are sounded together. These are divided into two classes, "differential tones," whose vibration frequency corresponds to the difference of the vibration frequencies of the two original notes; and "summational tones," whose vibration frequency corresponds to the sum of the same two quantities.

Combination Laws. Laws making illegal any combinations of tradesmen or laborers to change the rate of wages, hours of labor, or other conditions of service; also, decisions under the common law treating such combinations as criminal conspiracies.

Combination of Labor. Combined action of many persons in production; either under the form of actual co-operation in one physical process, of the ordinary division of labor, or of exchange of the surplus arising from the devotion of different persons or groups to one form of production.

Combinations. Results of associating n quantities from a group of m quantities in every possible way.

Combined Vapor Engine. Engine using some other vapor or gas in connection with the steam, either mixed in the same engine cylinder, or else in a second cylinder, so that the vapor is not mixed with the steam. The usual experience with such engines is that the complication and increased cost has not been compensated for by the economy attained by them when compared with a good steam engine of improved type. See ÆRO-STEAM ENGINE and CARBON DISULPHIDE ENGINE.

Combining Weight. In chemistry, number expressing the least weight of that element which will combine with another element.

Combretaceæ. Natural family of flowering plants of the class *Angiospermæ*, and sub-class *Dicotyledones*, comprising 18 genera and ab. 280 species, distributed throughout the tropics of both hemispheres.

Combustion. Union of oxygen with easily oxidizable substances at such a rapid rate as to cause the heat due to the chemical combinations to make them glow. The three conditions for proper combustion are high temperature, and room and time enough at that temperature for union with the oxygen supplied in sufficient excess. The usual combustions in the arts are those of carbon and hydrogen, separately or together. Carbon burning to carbonic oxide (CO) requires 68.66 cu. ft. of air to the pound of carbon; burning from C to CO_2 (carbonic acid), 1 lb. of carbon requires 137.5 cu. ft. of air. Hydrogen burning to water requires 419.7 cu. ft. of air to the lb. of hydrogen. The temperature necessary to start combustion is not exactly known, but Peclèt's investigations would show that it is higher than 750° F., at which solids begin to emit light from heat.

Combustion Chamber. Enlargement made in the flue passages back of a fire-box or furnace, so that combustible gases may have room and time enough to combine with oxygen and may be at a high enough temperature to burn. In boiler settings the boiler shell is always cooler than the point of ignition of carbon gases, and would act to put out the flame if the latter were kept so close as to be refrigerated. Hence the enlarged area or chamber for combustion. In locomotive boilers the combustion chamber is made by putting one or more partitions or bridge-walls across the fire-box, so that the gases do not pass at once into the tubes where they will be at once extinguished. The necessity for a combustion chamber is greater in proportion as the coal is soft or burns with a long flame. Anthracite furnaces need no such chamber. Most of the smoke-preventing appliances involve the idea of securing the inlet of excess of warmed air into an adequate combustion chamber.

Combustion Equivalent. Number of calories of heat that one grain of a substance will disengage on uniting with oxygen.

Comedo. Black-head; plug of secretion filling up the mouth of the duct of a sebaceous gland; usually dark colored and most common on the face.

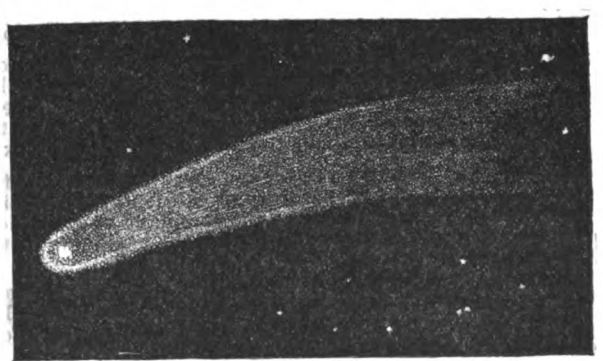
Comedy. Form of drama lighter than tragedy, but more serious than farce. It deals with the surface rather than the heights and depths of life, aims to delineate manners, and is often satiric. The most illustrious examples are those of Aristophanes, Shakespeare, and Molière.

Comella, LUCIANO FRANCISCO DE, 1716–1779. Spanish dramatist.

Comenius, or KOMENSKY, JOHANN AMOS, 1592–1671. Bp. of the Bohemian Brethren 1642. Persecuted in Moravia and Poland, he spent much time in teaching, and became the reformer, if not the founder, of educational methods. His *Open Door to Language*, 1631, and *Orbis Pictus*, 1658, were extensively translated and long valued. He sojourned in many lands, and died in Holland.

Comes. Smaller part of a double star.

Comet. Body revolving about the sun, usually in a long narrow ellipse or parabola, rarely a hyperbola, consisting in



Comet of 1811.

the normal case of a nucleus, coma, and tail. Their exact nature has been a subject of much speculation, but is still involved in obscurity.

Comet, BIELA'S. Discovered 1826 by Biela, an Austrian; period 6.6 years. It separated into two parts 1846, and has since disappeared, in consequence probably of further division and disintegration.

Comet, ENCKE'S. Its period is the shortest known, 3.307 years. It has become famous on account of Encke's conclusion that its motions could be accounted for only on the hypothesis that it suffered a resistance from some kind of medium filling the space in which it moves. Later researches partially confirm this conclusion.

Comet, HALLEY'S. Remarkable as the first whose return was successfully predicted. Halley so far solved the problem as to assign it a period of ab. 75 years, and to predict its return in 1759, which took place. It was again observed 1835. Its next return will be in 1911.

Cometography. Branch of physical astronomy dealing with comets.

Comfrey. *Symphytum officinale.* Coarse herb of the Borage family, native of Europe, introduced in N. America. It is strongly recommended for forage, especially where soiling is practiced, but its use has not yet become general.

Comfrey (*Symphytum officinale*).

Comfrey, WILD. *Cynoglossum virginicum.* Coarse, blue-flowered herb of the Borage family, native of e. N. America.

Comines, PHILIPPE DE, SIEUR D'ARGENTON, about 1445–1511. French historian and diplomatist. His *Memoirs* extend 1464–98, and mark the beginning of French history as distinct from the mere chronicle.

Comitia. Political meetings in ancient Rome. C. curiata, of the patricians; c. centuriata, of all the citizens; c. tributa, of the plebeians.

Comity of Nations. Admission of laws of one state within another, when not contrary to statute or intent of the latter.

Comma bacillus. Schizomycetous micro-organism, the *Spirillum choleræ asiaticæ*, found in the stools and intestinal contents of cholera patients, and regarded as the specific, infectious agent in production of that disease. They occur in curved, rod-like, motile filaments, from 0.00008–0.00012 of an inch long and often curved in the form of an S or a comma. They flourish best between 60° and 90° F.; are easily killed by drying, and live from 6 to 7 days in impure water.

Command. Body of troops, military or naval force, or post, under an officer, called commandant or commander. When different corps of the army join or do duty together, the officer highest in rank of the line of the army, marine corps or militia, there on duty, commands the whole. Command is exercised by virtue of office, or by special assignment. Without orders, from competent authority, an officer cannot put himself on duty by virtue of his commission alone.

Command. Height of the interior crest of a work above the level of the site on which it is constructed, or above another in its front. The command of the interior crest should be at least 6½ ft. to intercept the enemy's missiles and shelter the assailed, and at least 5 ft. above the parade of its own work.

Commands. Orders given for some military movement or evolution; of two kinds, preparatory or cautionary, indicating the movement to be executed, and the command of execution, given in a sharp, quick tone of voice for the beginning of the movement.

Commelin, JAN, 1629–1692. Prof. of Botany in Amsterdam. *Catalogus plantarum indigenasum Hollandiæ*, 1683–1709.—His nephew and successor, KASPAR, 1667–1731, wrote on the *Flora of Malabar*, 1696, and *Exotic Plants*, 1703–15.

Commelinaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Monocotyledones*, comprising 26 genera and ab. 300 species, widely dispersed through the warmer parts of the world; called the Spiderwort family.

Commemoration Day. Annual festival of Univ. Oxford, corresponding to Commencement elsewhere; it is usually on third Wednesday after Trinity Sunday.

Commendam. Old way of bestowing Ch. livings; abolished in England 1836.

Commensal. Animal which lives associated with another for protection, food, or mutual benefit. It shares only the food of its protector, while a parasite feeds on the juices or tissues of its host. An Amphipod (*Hyperia*), *e.g.*, lives in the mouth of certain Jelly-fish, and a small species of fish lives in the sub-umbrellar cavity of Jelly-fish. Oyster crab (*Pinnotheres*) is also an example.

Commensurable. Quantities which can be measured by a common unit.

Commerce. Interchange of goods, merchandise or property of any kind. Exchange of products has its origin in their diversity. Under the influence of commerce different places find it to their advantage to produce certain articles and to purchase others. In the U. S. commerce is divided into foreign, *i.e.*, trade relations with other nations; and internal, or domestic, which in quantity and value far exceed the foreign. See CHAMBERS OF COMMERCE.

Commerce. Game of cards, played with a full pack. Each player exchanges a card in turn with his left-hand neighbor until some one has a hand all of one suit, when he takes the pool.

Commercial Crises. Disturbances of trade, springing from various causes. Not infrequently they have originated in financial panics. The ordinary methods of payment have been impaired or destroyed in consequence of a general destruction of confidence, which has caused a sudden and great demand for money. The rates of discount rise; payments are made with great difficulty, and these events have a direct effect to retard or paralyze the operations of business. Such crises happen with some degree of regularity, about every ten years, and the period of recovery is often slow and painful. In 1893 a crisis of this kind occurred in the U. S. The ordinary sources of money supply suddenly became exhausted; payments could not be made, and business soon began to feel the effects of the paralysis. The panic soon passed, leaving a long-continued commercial depression.

Commercial Fertilizers. Material sold upon the market, that furnishes plant-food in the form of nitrogen, phosphoric acid, and potash, or any of them. Since the first class of such fertilizers that was largely sold was bone, or natural phosphates that had been rendered soluble with sulphuric acid, the term SUPERPHOSPHATE (q.v.), or phosphate, has come to be loosely applied to nearly all commercial manures.

Commination. Denunciation of judgments against sin; part of English Prayer-book, used on Ash Wednesday; abridged in that of P. E. Ch.

Commire, JEAN, 1625–1702. French Jesuit. *Poemata*, 1678.

Commissariat. Organization by which an army is furnished with subsistence supplies; called in the U. S. Army the Subsistence Department. It provides for the distribution and expenditure of money, and for the purchase, issue, and sale of (1) subsistence stores, rations, and articles for sale to enlisted men and officers, and forage for beef cattle, and (2) subsistence property, necessary means for handling, preserving, issuing, selling, and accounting for these supplies.

Commissary. Officers of the subsistence department. Commissary sergeants are non-commissioned officers, appointed by the Sec. of War from those who have served as such three years, and five years in the army.

Commission. Document authorizing the exercise of powers and performance of duties pertaining to some particular office. They are issued by the Pres. of the U. S. to officers in the army and navy, who are confirmed by the Senate.

Commissionaires. (1) Employees of hotels in Europe, for outdoor work. (2) Former soldiers and sailors, formed into a corps 1859 in England for public service.

Commissioners. State or U. S. officials, discharging various functions.

Commissure. Two inner faces of organs lying side by side; especially those of the two mericarps in fruits of the Carrot family.

Committee. Members of a legislative or other body, officially intrusted with some especial task.

Commodianus, ab. 250. Latin Christian poet.

Commodities, or GOODS. Things of use to mankind; divided into internal and external, transferable and non-transferable, of consumption and of production.

Commodore. Naval officer between captain and admiral; rank fixed in U. S. 1862, equal to that of brigadier-general.

Commodus, LUCIUS AURELIUS, 161–192. Roman emperor 180–192; unworthy son and successor of Marcus Aurelius; notorious for his appearances in the amphitheater. He was strangled by an athlete.

Lucius Aurelius Commodus.

Common Divisor. Any quantity which exactly divides each of two or more quantities.

Common Law. Body of legal principles established by judicial decisions, as distinguished from statute law. Each of the U. S., except Louisiana, recognizes the English common law, and the English statutes passed prior to the settlement of America, as the basis of its jurisprudence. This body of principles is looked upon as an expanding and progressive system, rather than as a code.

Common Multiple. Quantity which exactly contains each of two or more quantities.

Common Prayer, Book of. Begun in England as Henry VIII.'s *Primer*, 1546; revised 1549, 1552, 1559, 1604, 1633, and finally 1662. For the American P. E. Church it was further altered 1789, and revised 1892.

Commons and Inclosures. Land over which the inhabitants of a village or manor have rights, especially of pasturage. Common also signifies the profit that a man has in the land of another person, usually in common with others; or the right to pasture his cattle in land not his own.

Commons, House of. Originated in an assembly summoned by writs issued in the king's name by Simon de Montfort, Earl of Leicester, 1264. It consisted of 2 knights from each shire, 2 representatives from each city and borough, 23 lay barons and 120 of the clergy (though only 11 prelates had been summoned). It met in London, Jan. 30, 1265. Its power dates from the reign of Charles I., and its history is that of English liberty.

Common Schools. Though the ancient republics enforced and, in a measure, supervised education, yet the schools were not free. Until the reformation the Church in w. Europe was primarily responsible for what instruction the masses received. In Germany the Reformers first started public schools, but the religious wars retarded the movement for another century. Prussia established common schools 1713, and Frederick II. decreed compulsory education 1763. France favored the movement at the Revolution but nothing was done till 1833. Scotland started common schools 1696, but the English government did not take charge of education till 1870, though the State lent some aid from 1832 on. In New England public schools were extended by laws of 1642, 1647, and 1650. Under the Dutch in New York education was inferior and no common schools existed in the S. States. Since 1820 the system has universally extended in the U. S. See Compulsory Education.

Common Sense. Defined by Aristotle as the sense which unifies the different sensations and is the universal element of sensory experience; hence, intelligence, sagacity, and prudence, common to all men. It has given rise to a school of thinkers opposed to idealism, transcendentalism, and skepticism. In ethics, it is the consensus of mankind as to those rules of moral conduct by which particular questions are to be settled.

Commonwealth. Government of England from death of Charles I. to restoration of Charles II., 1649–60, including the protectorates of Oliver Cromwell 1653–58, and his son Richard, 1658–59.

Commune of Paris. March 18–May 27, 1871; suppressed after obstinate and bloody fighting, in which 6,500 Communists fell and some 30,000 were made prisoners. They had murdered Abp. Darbog and others, and destroyed the finest buildings and monuments of Paris.

Communications. All roads, rivers, canals, bridges or other means of passage, by which parts of the same army or of different armies can maintain free connection with each other. In permanent fortifications, means by which ready access can be had to all parts of the work or to its outworks, and free circulation of the troops and munitions within the work. Among the latter are bridges, galleries, postern, ramps, stairs, and caponiers.

Communion. See Eucharist.

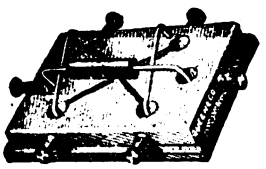
Communism. Proposed form of social organization, in which the results of economic production would be distributed either equally or according to some determined proportion. The former should properly be considered as laying the greater stress on the equality of the actual distribution, while the latter pays more attention to the social control of the means of production, still in the interests of greater equality.

Community Property. That acquired by husband and wife during marriage; an institution not known to the English common law, but found in several States whose territory was acquired from France and Mexico. The surviving spouse generally has half, the balance going to the heirs.

Commutation. Allowance to officers on duty, without troops, at stations where there are no public quarters.

Commutative. Subject to change of arrangement without effect upon the result. In ordinary algebraic addition a+b=b+a. So in ordinary multiplication abc=bca=cab. In higher analysis operations become non-commutative.

Commutator. Device to change the direction of an electrical current, consisting of four mercury cups placed at the corners of a square; these may be joined in pairs consecutively or alternately by a pair of wires bent twice at right angles. The direction of the current in a circuit terminating in two of the cups is directly dependent on the position of the wires. In a dynamo-machine the contacts should be so arranged that, while the currents within the machine are reversed, at least twice in every revolution of the machine the current in the outer circuits shall always have the same direction. A rheotrope is any instrument for changing the direction of flow.


Commutator.

Comneni. Byzantine dynasty, 1057–1204. A branch of this family held Trebizond till 1462.

Como. Ancient city of n. Italy, 25 m. n. of Milan; birthplace of Pliny. Pop. ab. 27,000.

Como, Lake. In n. Italy; of notable beauty; 35 m. long.

Comonfort, Ignacio, 1812–1863. Pres. of Mexico 1857.

Comoro Isles. In Mozambique Channel; held by France. Pop. ab. 47,000.

Company. Unit of command in military organization; commanded by a captain. A company of infantry in the U. S. Army consists of three commissioned officers and sixty men; as does a troop of cavalry; a battery of artillery has one additional officer.

Company Stores. Maintained by employers, where their employees are expected or compelled to deal. Though in many States forbidden by law, they continue to flourish. It has been asserted that some coal-operators owning such stores have sold their coal at a loss, much below the price of their competitors, setting against this the profits made on goods sold to their employees under the store-order system.

Comparative Anatomy. Systematic comparison of the structure of all animals with a view to discovering the evolution of organs and the relations of groups of animals. This science was founded by Cuvier (q.v.).

Comparative Philology. Study of languages, not as individuals, but in groups based on related forms, whereby the separate facts are made to explain one another and furnish rules for the whole system. Researches in any one language lead only to actually known facts; comparative philology, with reasonably safe inference, throws light on a past which has left us no actual data, and is thus of enormous importance in history and ethnography. See Bopp, and Grimm's Law.

Comparative Psychology. Study of mind in its stages of development other than that of the normal adult human mind. It embraces four fields of investigation. (1) The manifestations of mental activity in the lower animals. The scientific treatment of this branch of the subject is of recent date, having been stimulated into activity largely by the writings of Darwin, and has contributed much to our knowledge. (2) The human mind in its early stages of development. (3) The products and expressions of mind in the society, religions, customs and institutions of different classes and peoples. (4) Psychiatry, the observation of mind in its variations from the normal and healthy state, as in insanity, idiocy, hypnotism and aphasia. Comparative psychology is sometimes improperly regarded as synonymous with animal psychology.

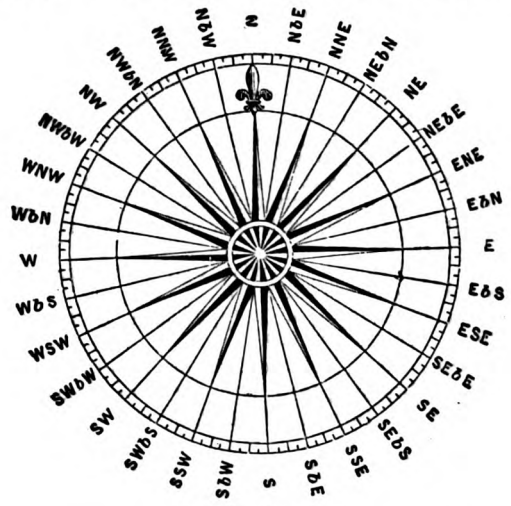
Comparator. Apparatus for comparing linear dimensions. It consists of two reading microscopes moving upon the same guide-bars and capable of adjustment in a direction perpendicular to their length. The cross-wires of the microscopes are set upon the two lines whose distance apart is to be determined. The object is then removed and replaced by a standard scale, upon which the distance between the cross-wires can now be read off.

Comparetti, Domenico Pietro Antonio, b. 1835. Prof. of Greek at Pisa and Florence; writer on mediæval topics and dialects.

Comparison. See Judgment.

Compass. Instrument used to indicate the magnetic meridian or the position of objects with reference to it. Its chief forms are the mariner's, azimuth, and variation compass. The essentials of these are the same, and consist of (1) a magnetic needle balanced on a point and capable of turning in a horizontal plane; (2) a circular disk, either attached to the needle and turning with it, or fixed in position and placed below the needle as in the azimuth. This card is graduated around its

circumference into 32 divisions, each divided into halves and quarters, and called the points of the compass. The mariner's compass, shown in the cut, indicates the direction of the ship at any instant. The compass was first used by the Chinese, who claim that it was known 2634 B.C. The power of the loadstone to impart polarity to iron is mentioned in a Chinese dictionary



Compass.

A.D. 121; the earliest mention of its use for navigation places it between 265 and 419. The Chinese needle is ab. 1 inch in length and points to S. The compass was used in both Syrian and Indian Seas before 1250, and is mentioned by Guiot of Provence 1190. The 32 points are recognized by Chaucer 1391. The invention is sometimes ascribed to Flavio Gioja of Amalfi, ab. 1302. See DECLINATION and VARIATION OF THE NEEDLE.

Compass (BEAM). Instrument for measuring lengths, consisting of a long graduated beam with one steel compass point fixed at one end of it, and another attached to a sliding piece usually provided with a fiducial mark and vernier.

Compasses. Pair of dividers, used by draftsmen for describing circles.

Compassion. Development of the benevolent affections involving pain at the sight of pain in others.

Compass-Plant. *Silphium laciniatum.* Large herb of the Composite family, native of the N. American prairie region; known as Polar-Plant, from the supposed habit of its leaves facing always n. and s.

Compensation Balance. Balance wheel of a chronometer so constructed that its time of oscillation will be unchanged with changes of temperature. The principle is that of differential expansion, the rim being divided radially into three or four parts, each attached to a spoke, and the parts formed of two metals differently expansible, the more expansible being on the outside. As the spokes become longer with a rise of temperature, the circumferential parts bend toward the center, producing the compensation.

Compensation for Unexhausted Improvements. Indemnification paid to a tenant on the expiration of his period of occupancy for improvements he has put upon the land, the value of which is not yet exhausted; compulsory in several modern countries.

Compensation in Language. Where, *e.g.*, a consonant drops out after a short vowel, and the latter is lengthened. Compare Eng. *five* with Ger. *funf*.

Compensation of Clock, FOR BAROMETRIC CHANGE. Accomplished by connecting a magnet with the mercurial column of a barometer. When the mercury rises, the magnet approaches the pendulum, accelerating the motion sufficiently to compensate for loss due to increased density of air.

Compensation Pendulum. See CLOCK PENDULUM.

Complaint. Formal statement to a magistrate, accusing another of a crime; also the first pleading in a civil action.

Complanar. In the same plane; applied to vectors in quaternions.

Complemental Males. Small male Cirripedes, parasitic upon their females. The latter are nearly hermaphrodite forms, *e.g.*, *Ibla* and *Scalpellum*.

Complementary Colors. Any two colors the combined effect of which is white; *e.g.*, red is complementary to bluish green, orange to light blue, yellow to violet blue. If the solar spectrum be divided into any two parts, the resultant tints when the constituents of each of the parts are combined are complementary to each other.

Complementary Males and Females. Partially developed sexed individuals, kept in a termite nest to replace the king and queen in event of their death.

Complements. Magnitudes which together fill some arbitrary measure, as two arcs or angles when their sum equals 90°.

Complements, OF A PARALLELOGRAM. Minor parallelograms formed by lines through any point on the diagonal parallel to the sides of the original parallelogram. They are always equal to each other.

Complex Fraction. One having a fraction in one or both of its terms.

Component. Single directed quantity; *e.g.*, a motion or a force, which may be replaced by others of the same kind with the same effect. See RESULTANT.

Compositæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising ab. 800 genera and 12,000 species, widely distributed through all parts of the earth; called the Composite family.

Compositæ (ASCIDLÆ COMPOSITÆ). See ASCIDIANS.

Composite Demand. Total demand for any factor of production or any finished product. In the first case, it is made up of the sum of the derived demands for the given object in its several uses; in the second, of the sum of partial demands of the several classes of society for the given commodity.

Composite Number. One having integral factors other than itself and unity; opposed to prime number.

Composite Order. See ARCHITECTURE.

Composite Supply. Sum of supplies of all the rival commodities tending to satisfy any given want.

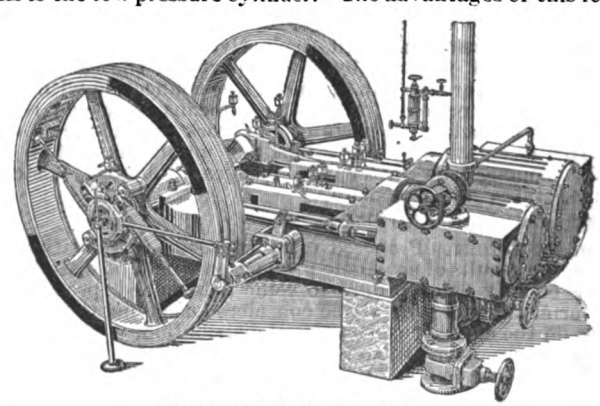
Composition (IN PROPORTION). Comparing sum or difference of antecedent and consequent with either element separately. If A:B::C:D, A±B:A::C±D:C.

Composition with Creditors. Arrangement between a debtor and part or all of his creditors, by which they release him from his debts on terms differing from those of his original obligations.

Compost. Mixed animal, vegetable and mineral matter, which by fermentation forms a valuable fertilizer. Comparatively worthless refuse may thus become a good top-dressing for poor pastures.

Compound. In chemistry a substance composed of two or more elements united by chemical affinity, the individual characteristics of which have been lost. A given compound is always of the same composition, the proportion in which the elements are present never varies.

Compound Engine. Steam engine with two cylinders. One receives steam from the boiler and exhausts it at a pressure higher than the atmosphere; this is the high pressure cylinder. This exhaust from the first cylinder enters the second cylinder, whose area is three to four times that of the first, and after working in it is exhausted into the condenser. This is the low pressure cylinder. The advantages of this form



Compound Condensing Engine.

of engine over the single cylinder condensing engine are that: first, the steam can be used at high expansions and with high initial boiler pressure, and yet follow the crank through a large angle from the dead-points; this follows from the greater volume of the second cylinder into which the steam from the first expands. Second, that the range of temperature (from initial boiler to final condenser temperatures) occurs in two cylinders instead of one; the transfer of heat from cylinder

walls varies as the difference of temperature of the bodies imparting and receiving heat, and with a given total limit, the range in each cylinder is less, and hence the transfer less. This is more important in proportion as the speed of engine is slow, giving thereby more time for internal condensation and re-evaporation to take place. Third, following from the use of two cylinders, the irregularity of shaft motion is less. The two cylinders are arranged in several ways; first, on the same piston-rod (tandem or steeple engines), the second cylinder behind the first; second, with two rods, cylinders side by side (fore-and-aft engines), with cranks at 0°, 180° or 90° apart. The latter are called receiver or tank engines, the high pressure cylinder exhausting into a receiver, from which the low pressure takes steam. In beam engines the two cylinders may be on the same or opposite sides of the beam center and may be parallel or inclined to each other. Compound engines are almost entirely used for marine propulsion and for large pumping or factory plants. Triple and quadruplex engines, with three and four cylinders respectively, are also used.

Compound Ethers. See ETHEREAL SALTS.

Compound Eye, OF INSECTS. Paired, large eyes, consisting of numerous prismatic elements, each with its lens and cornea at outer end, and retinal or nervous elements at inner end.

Compound Fraction. One having fractional factors formally expressed.

Compounding Crime. Forbearing to prosecute in consideration of the criminal's restoring property, or of some reward; a common law misdemeanor. The agreement on the part of the criminal or of one in his behalf cannot be enforced, as its consideration is illegal.

Compound Radicals. See RADICALS.

Comprehensive, or SYNTHETIC, **Types.** Animal groups with generalized characters showing a differentiation into generic or subordinate groups whose characters resemble those that differentiate higher animals of the same class into groups of a higher grade. Thus the neuropterous insects have forms that mimic the remaining orders of insects. Similarly the saurians of past ages had forms allied to amphibians, birds, and mammals.

Compressed Air. See AIR-COMPRESSOR and AIR-ENGINE.

Compressed-Air Bath. Ærotherapeutic treatment has been considerably studied, but the results have not been encouraging. The patient is placed in a strong chamber and air is driven in or withdrawn as the case may require. Patients remain in the bath from 1 to 3 hours under a pressure of ab. 1½ atmospheres. Breathing compressed air lessens the frequency of the pulse-beats, permitting the absorption of oxygen and increases the tension of the blood. Rarefied air produces opposite effects. Compressed air is used in chronic bronchitis, asthma and catarrh, and emphysema is treated with rarefied air.

Compressed-Air Motors. See AIR-ENGINE and AIR-COMPRESSOR.

Compressibility. Measured by the facility with which a change of volume is produced by the action of external forces; ratio of the cubical compression per unit of volume to the pressure producing it. In symbols it is $\frac{v}{Vp}$, in which V is the initial volume of the body, p the increment of pressure, and v the decrement of volume.

Compressibility of Water. The popular opinion that water is incompressible is not justified by experiments, which show that it is far more compressible than iron. A column of water contained in a pipe 100 ft. long will be shortened ab. four in. if a pressure of 1,000 lbs. per sq. in. be applied at its ends.

Compression. Strain resulting when the volume of a body is decreased by a stress.

Compressive Strength. Amount of pressure which will crush a block, or cause it to crack and splinter; measured in lbs. per sq. in. of the surface to which the pressure is applied. The average compressive strength of timber is 8,000 lbs. per sq. in., of brick 3,000, of stone 6,000, of cast iron 20,000, of wrought iron 55,000, and of steel 150,000; but these are subject to much variation with the quality of the material.

Compressor. See AIR-COMPRESSOR.

Compromise Benefit of a Monopoly. Should the owner of a monopoly wish, not to obtain the largest immediate net revenue, but to favor, for ulterior advantages, the consumer, he must add to his calculation of net revenue at least a portion of the consumer's rent, and fix such a price on his monopoly as will make the combined sum as large as possible. Such a sum is known as Compromise Benefit.

Comptroller. Officer appointed to examine and certify the accounts of a department of the government, first appointed in the U. S. 1772. The First Comptroller of the Treasury looks after the Treasury, Navy, War, and Interior Departments. The Pension and Indian bureaus are under the Second Comptroller of the Treasury. The Comptroller of the Currency has charge of the matters relating to the National Banks, issues their notes, and renews worn-out currency.

Compulsory Education. In the ancient republics every citizen received the same education, which was prescribed by the Government. Of late years many European countries have enforced school attendance between certain ages, especially France, Germany and Great Britain. In the U. S. similar laws have been passed in 29 States and Terr.: viz., Cal., Col., Conn., D. C., Id., Ill., Kan., Me., Mass., Mich., Minn., Mont., Neb., Nev., N. H., N. J., N. M., N. Y., N. D., O., Ore., Penn., R. I., S. D., Utah, Vt., Wash., Wis., and Wyo. The prevailing feature of these laws is to require children of from 8 to 14 years to attend school from 12 to 16 weeks each year, fining parents $25 for first offense and for subsequent offenses increasing the fine or in some cases ordering imprisonment. Some States appoint special truant-officers, and many provide reform schools for truants. Employment is forbidden for young children during the hours of school sessions, 10 and under being the prohibited age in Vt. and R. I., 12 in Me., N. J., O., and Wis., 13 in Conn., Mass., N. H., and N. Y. These and some other States prohibit employment until the prescribed education has been given. Compulsory education also exists in the British colonies.

Compulsory Insurance. Insurance of workmen against accident, sickness, or old age, made compulsory by law, at the expense of the employer, or of employer and workmen; introduced recently in Germany and Austria.

Comstock, ANTHONY, b. 1844. Agent N. Y. Society for Suppression of Vice since 1873.

Comstock, THEODORE BRYANT, Ph.D., b. 1849. Prof. Cornell Univ. 1875–79, Univ. Ill. 1884. *Geology*, 1878.

Comstock Lode. Fissure vein of extraordinary width and productiveness situated in the w. part of Nevada, on the e. side of Mt. Davidson, partly under the towns of Gold Hill and Virginia City, tending in a direction ab. 25° E. of the magnetic meridian. It was accidentally discovered in 1859 and named after one of the chief speculators there and not the discoverer. The lode as commonly spoken of is made up of a number of branch lodes and chimneys of ore separated by vein matter consisting mostly of porphyritic rock, quartz, and clayey seams, all in a very complex form. The principal minerals found are native gold and silver, argentite, polybasite, stephanite, galena, and pyrargyrite. In the quartz occur carbonates of lime, magnesia, lead, and copper. The most noted mines on this lode are Consol., Cal. and Va., Hale & Norcross, Chollar-Potosi, Belcher, Ophir and Gould & Curry. In 1874 a great bonanza was struck, from which the ore assayed $600 a ton and upward. The percentage of gold in the ore varies from ab. 30 to 70 per cent. It was worked at first for gold, the silver, occurring as a sulphuret, being thrown away. The production of gold and silver in 1891 amounted to $3,100,000, of which $1,200,000 was gold; and the entire production in gold and silver since its discovery including 1891 amounts to $351,155,688.68. Shafts have been sunk to the depth of 2,300 ft. The heat (50° C.) and steam generated by the action of the air on the sulphurous rock through which the levels are driven preventing the miners from going deeper.

Comte, AUGUSTE, 1798–1857. French philosopher, author of the system known as Positivism, in which human development is characterized by three stages, theological, metaphysical and positive. The first two are attempts to know "things in themselves"; the last limits knowledge to mere phenomena. His great work was *The Positive Philosophy*, 6 v., 1830–42, showing the necessity of a science of society and the development of all human knowledge with reference to social organization. After confinement in an asylum and recovery from an attack of insanity he founded what he called The Religion of Humanity, in which woman was to be the priest and Humanity took the place of Deity.

Comus. God of revelry, represented as a winged youth.

Conant, THOMAS JEFFERSON, D.D., 1802–1891. Prof. at Waterville, Me., 1827; Hamilton, N. Y., 1835, and Rochester, N. Y., 1851; reviser Am. Bible Union 1857–75. He tr. Gesenius' *Hebrew Grammar*, 1839–51, and much of the Scriptures.

Concaulescent. Pedicel of a flower which is adnate to the axis of inflorescence.

Concave. Line or surface at any point on the side opposite the rectilinear tangent at the point.

Concave Order of Battle. Order of battle of an army attacking by both wings, refusing the center. When the attack is by the center with the wings retired, it is convex; when by one wing, with the center and other wing retired, oblique;

when both wings and center are brought simultaneously into action, it is parallel.

Concealed Weapons. Carrying pistols, dirks, etc., willfully kept from sight upon one's person, is a statutory offense in many States. Such statutes do not impair the constitutional right to keep and bear arms.

Concentrators. Machines to separate the richer from the poorer parts of a mass of ore; differing widely in style of construction and mode of action.

Concentric. Having coincident centers.

Concept. In logic, a general idea, the formation of which is one of the stages in a process of thought, the others being the stating of a proposition and the drawing of an inference, or reasoning proper. These are not distinct operations, but phases of a complex act. In psychology, an idea having a general import; a mental image symbolic of a principle or a class.

Conceptacle. See SPOROCARP.

Conception. Act of becoming pregnant; *i.e.*, the attachment of a fecundated (fertilized) egg to the vascular membrane lining the uterus.

Conception, POINT. Upon the coast of Cal., lat. 34° 30′ n.

Conceptualism. Theory that general abstract ideas had reality or real things for their objects, but did not represent the nature of the things denoted by them; intermediate between NOMINALISM and REALISM (q.v.).

Concertina. Musical instrument, related to the accordion; invented in London 1829.

Concerto. Musical composition for a solo instrument with orchestral accompaniment, written in the classical sonata form, or a modification of it, as by the omission of the scherzo. There are also double and triple concerti with two or three instruments.

Concetti. Conceits in literature; fanciful turns of thought or language, prevalent 1550–1650; in England, called Euphuism.

Conch. See CHANK SHELL.

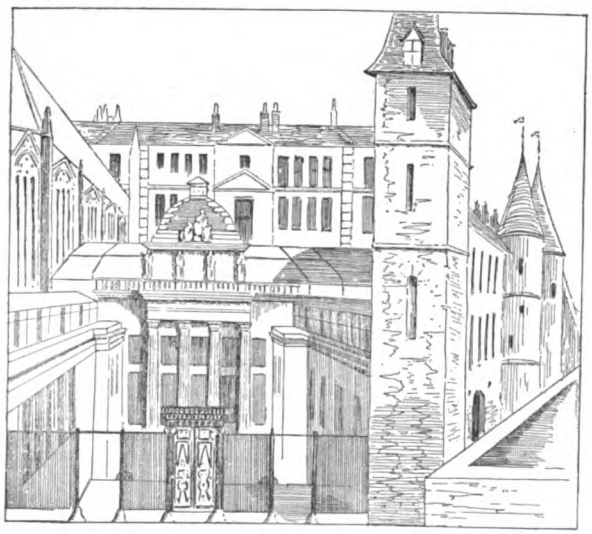
Concha, MANUEL GUTIERREZ DE LA, MARQUIS OF DUERO, 1794–1874. Spanish General.—His brother, JOSE, b. 1809, was Gov. of Cuba 1849–52, 1854–59, and 1874–75.

Conchifera. Group including the Lamellibranchs and Brachiopods; now obsolete, as these classes are not closely related.

Conchoid (OF NICOMEDES). Curve formed by laying off on straight lines, proceeding from a fixed point, equal distances from a fixed transversal. It is used for trisecting an angle, for constructing two geometrical means between two given lines, and for the duplication of a cube.

Conchology. Science which treats of the Molluscs (and in broad sense also the Brachiopods) in their zoölogical relations to one another and to Man.

Conciergierie. Old prison of Paris, in which the victims



Conciergierie.

of the Revolution were confined. It is the only remaining historical prison in Paris, but has been much altered.

Conciliation. In economics, settlement of disputes between employer and employees by intervention of a common representative, without reference to formal arbitration.

Conclave. See CARDINALS.

Concomitance. R. C. doctrine, that the consecration of the Eucharistic bread transubstantiating it into the body, and of the wine into the blood of Christ, by necessary association all the other elements of our Lord's being are conjoined with each, and that therefore communion under either species insures the reception of the entire and perfect Christ. This theory justifies the withholding of the cup from the laity.

Concomitant. In higher analysis, covariants and contravariants.

Concord. Town of Middlesex co., Mass., famous for a battle which, with the skirmish at Lexington, on the same day, April 19, 1775, marked the beginning of the Revolution. Here the Americans fired their first shot under order of their officers, and two British soldiers were killed. The village is famous also as the residence of Emerson, Thoreau, and for a time of Hawthorne. Pop., 1890, 4,427.

Concord. Capital of New Hampshire, on Merrimack R.; founded 1725, chartered as a city 1853. Pop., 1890, 17,004.

Concord, FORMULA OF. See FORMULA.

Concordance. List of leading words occurring in any book or series of books, as the works of Shakespeare or Tennyson. The earliest Biblical concordance was made 1244; the most familiar English one is A. Cruden's 1737.

Concordat. Compact between the pope and a temporal prince. That between the emperor Henry V. and Calixtus II., 1122, has been held to be the fundamental law of the Ch. in Germany. That between Napoleon and Pius VII., July 15, 1801, made Napoleon virtual head of the Gallican Ch. That between Austria and Rome, Aug. 18, 1855, surrendered many of the liberties of the Austrian Ch., and was abolished 1870.

Concrete. Opposed to abstract, and so representative of real individual things; the names of things are concrete, of qualities, conceived or spoken of as things, are abstract.

Concrete. See BÉTON and ARTIFICIAL STONE.

Concretions. Nodules often taking fanciful or imitative shapes; formed by the consolidation of material round some substance, as a stem, leaf, shell, or fish. See CALCULI.

Concubinage. State of secondary marriage common among the ancients and encouraged in the case of a barren wife. Though at first respectable, its abuses in Rome led Augustus to confine it to women of the lower orders, and the Emperor Leo prohibited it at Byzantium. It still exists as Morganatic Marriage.

Concurrent Points. Those of coincidence, which are neither of intersection nor tangency.

Concussion. Violent jarring of an organ, disturbing its molecular arrangement, or causing minute hæmorrhages in its substance, which cause more or less interference with its functions, according to the amount of injury inflicted.

Concussion Theory OF PRODUCTION OF RAIN. Belief that rain is formed directly from otherwise clear air by any violent concussion, as gunpowder or dynamite explosions and thunder. Although this theory has no physical support, yet rain following great battles is quoted as an argument in its favor.

Concussive Ebullition. Phenomenon observed when highly heated water (which has been kept by pressure from becoming steam) is allowed suddenly to form steam by release of pressure. (See BOILING POINT.) The laboratory experiment was first made by Dufour, who heated up segregated globules of water in oil. When these heated drops were brought to the surface of the oil they became steam instantly, and the sudden increase of their volume caused a concussion. "Water-hammer" or snapping of steam radiators is the same thing. Water collects in a pocket, condenses steam by contact, and causes a vacuum above the water. The hot water vaporizes instantly into the vacuum, and the reaction causes a blow of considerable intensity. In large pipes such a blow may be very destructive.

Condé, JOSE ANTONIO, 1765–1820. Spanish historian.

Condé, LOUIS I., DE BOURBON, PRINCE DE, 1530–1569. Huguenot leader, uncle of Henry IV.; condemned to death 1560 for the conspiracy of Amboise; in command at Dreux 1562, and St. Denis 1567; killed at Jarnac.—His great-grandson, LOUIS II., 1621–1686, called the Great Condé, defeated the Spaniards at

Rocroi 1643, the Bavarians at Freiburg and Nordlingen 1644–5; took Dunkirk 1646; won another victory at Lens 1648; was imprisoned 1650–51; raised the third war of the Fronde; served

Conde, Louis I.

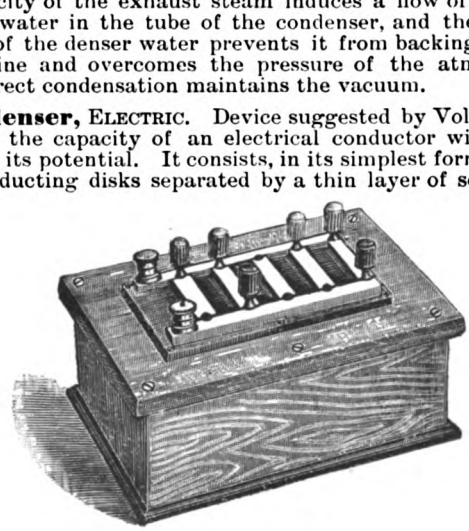
Spain against France 1653–59; changed sides again, and succeeded Turenne in command 1675.

Condemned Property. Public property in use in the military service, when it becomes unserviceable, is inspected and condemned. Every such article is examined in the presence of the officer responsible for it, who is required to give all necessary information as to its use, care, means taken to preserve it, and its present condition, with the cause thereof, before the inspector can condemn it. If found to be utterly worthless it must be so far destroyed as to prevent any possibility of future presentation.

Condensation Theory. Advocated by Abbe; it makes the general motion of the larger storms depend principally on those conditions that favor the formation of cloud or rain.

Condenser. Apparatus in which the steam exhausted from the cylinder of a condensing engine is converted into water. Four types are used. 1. Jet condensers, where the water condenses the steam by direct contact with it, entering either in a plain jet or through a scattering plate which breaks the water into fine streams. 2. Surface condensers, where the water cools a large number of small tubes against whose cooled surface the steam impinges (the steam may be either outside or inside of the tubes). 3. Siphon condensers, in which the condensing box is put more than 32 ft. ab. the surface of the water in the hot well below which the pipe from the bottom of the condenser passes so as to be air-sealed. A Torricellian vacuum is theoretically to be realized, as water will not rise more than 32 ft. in the tube, but air must be drawn out by the principle of induced currents. 4. The ejector condensers, where the velocity of the exhaust steam induces a flow of the condensing water in the tube of the condenser, and the velocity of flow of the denser water prevents it from backing up into the engine and overcomes the pressure of the atmosphere, while direct condensation maintains the vacuum.

Condenser, ELECTRIC. Device suggested by Volta for increasing the capacity of an electrical conductor without increasing its potential. It consists, in its simplest form, of two thin conducting disks separated by a thin layer of some non-



Electric Condenser.

conductor; *e.g.*, a glass plate. One of the disks, called the "collecting plate," is connected with the prime conductor of an electrical machine, while the other, known as the "condensing plate," is connected by a chain or wire to the earth. A positive charge on the collecting plate will induce a negative charge on the opposite side of the dielectric, which in turn will react upon the collecting plate, attracting the electricity to the surface of the dielectric; thus the plate is enabled to draw more positive electricity from the machine. The "condensing power" is the ratio in which the capacity of the collecting plate has been increased by the pressure of the condensing plate. Condensers of larger capacity are often made of sheets of tin foil separated by plates of mica or layers of paraffin; in this case the alternate sheets of foil are joined at their edges and form the collecting plate, while the rest are joined together for the condensing plate.

Condenser, OPTICAL. Convex lens used in a projecting lantern for strongly illuminating the picture which is to be magnified on the screen. It is placed between the light and the slide, and at such a distance that the latter just fills the solid angle occupied by the converging rays.

Condenser, PUMP. An air-pump with the valves reversed may be used to condense a gas in any closed vessel, and is then called a "condensing pump."

Condensing Engine. One in which the steam which is discharged from the cylinder after doing work is condensed back to water. The essential parts which have to be added to a non-condensing engine for this purpose are the CONDENSER (q.v.), the cold well, and the hot well. There is also an air-pump required for many designs. The advantages are: first, the higher efficiency of the fluid used, inasmuch as the steam escapes at a lower absolute temperature than when it exhausts to the air, and the theoretical efficiency is greater, as the difference is greater between initial and final temperatures in the cylinder. Second, owing to the lowering of the back pressure below atmosphere on the exhaust side of the engine piston, an engine of given size will exert more power condensing than when non-condensing (or for a given work a smaller cylinder can be used); and lastly, there need be less waste of heat, inasmuch as the warm condensed water can be pumped back into the boiler.

Condensing Power, ELECTRIC. Ratio in which the capacity of the collecting plate has been increased by the presence of the condensing plate.

Conder, JOSIAH, 1789–1855. English poet; ed. *Eclectic Review*, 1814–37, and *Cong. Hymn Book*, 1836. Some of his hymns are in general use.

Condillac, ETIENNE BONNOT DE, 1715–1780. Philosopher; Academician 1768; founder of the French school which adopted the sensationalism of Locke. *Essai sur l'Origine des Connaissances humaines*, 1746; *Traité des Systemes*, 1749; *Traité des Sensations*, 1754.

Condition. In conveyances, a term which provides that an estate shall commence, be enlarged, or be defeated upon a prescribed occurrence. In contracts, a statement or promise which is an essential term of the contract and whose breach entitles the party in whose favor it exists to a discharge. It may be precedent, concurrent, or subsequent.

Condition. In philosophy, only partly identical with cause. All causes are conditions, but not vice versa. A condition is something whose absence may prevent a certain event, but whose presence may not be sufficient to produce it. A cause is an active, a condition is a passive, agent.

Conditional Limitation. Grant of an estate to A. upon condition that in a certain event, such as A.'s death without issue, it shall go to B.

Conditional Sale. Agreement to sell property upon the performance of some condition by the purchaser; the title remains in the seller until such performance. At common law such an agreement is valid between the parties and as to third persons; a different rule obtains in Pa., and modern statutes in many States require such agreements to be written and filed in a public office, in order to be valid against *bona fide* purchasers from the original buyer.

Conditioned, PHILOSOPHY OF THE. Doctrine of Sir Wm. Hamilton, as to our inability to conceive the Absolute and Infinite; further urged by Dr. H. L. Mansel, 1858.

Condonation. Forgiveness of an offense, especially domestic infidelity; admissible as a bar to a suit for divorce.

Condor. *Sarcorhamphus gryphus.* Largest of vultures, averaging 9 ft. wing expanse, lives among the peaks of the Andes but descends for food. Its feet are not adapted for grasping, cannot truly perch nor carry objects when flying, sleep soundly and can be lassoed at night. Kills small quadrupeds, besides feeding on carrion. Lay two white eggs 4 in. long, on bare rock, hatched in 7 wks. Young are brown and a year old before they can fly. Male is black with white ruff, wing

bars and tip of bill; wattles present on head and breast. Female lacks comb, wattles, and has less white. Young do not

Condor.

acquire full plumage for 6 yrs. Condor depends more on sight than smell in finding food. See VULTURIDÆ.

Condorcet, MARIE JEAN ANTOINE NICOLAS DE CARITAT, MARQUIS DE, 1743–1794. French mathematician, philosopher and publicist, one of the encyclopedists; academician 1769; proscribed 1793, and died in prison. *Calculus*, 1765. His *Progress of the Human Spirit*, 1795, was written while in hiding.

Condottieri. Leaders of Italian mercenaries 1300–1500. They served under any prince who would employ them, and were always ready to change sides for higher pay.

Conduct. Army regulations forbid superiors from injuring those under them by tyrannical or capricious conduct or abusive language. "*Conduct unbecoming an officer and a gentleman*," and "*to the prejudice of good order and military discipline*," are, by the 61st and 62d Articles of War, military crimes; though nowhere specifically defined, they are sufficiently so by customs of the service and judgments of courts-martial.

Conduct. Habitual action looked upon from the point of view of its moral character.

Conduct, ART OF. Science of ethics.

Conduction. Transmission of heat or electricity through the substance of a body. If heat be applied at one end of a bar, two stages may be distinguished: (1) the "variable state," during which all portions of the bar sufficiently near the source are rising in temperature; (2) the "permanent state," in which the bar is receiving no more heat than it loses by radiation or convection.

Conductivity, THERMAL. Property of transferring heat energy from one point to another through the substance of a body. It is independent of absorption and of thermal capacity.—ELECTRICAL. That property of a substance by which it allows electricity to traverse it; the reciprocal of resistance. In general the metals are the best conductors, but their conductivity varies inversely as the absolute temperature.

Conductor. In music, leader of a choir of singers or instrumentalists, whose duty it is to indicate the time of the music, keep the various parts together, give the signal for the entrances of parts or instruments, suggest nuances of expression and the like. He stands in front of the players facing them, and guides them with a baton and his eyes; this is a comparatively late innovation. In the last century he sat at the harpsichord and beat time only at intervals. As a rule dance orchestra conductors still face the audience, beat time with a violin bow, and occasionally play the violin. At the Paris Grand Opera the violin bow has not yet been replaced by the baton.

Conduit. Timber or masonry channel used for conveying water; an aqueduct.

Conduplicate. Method of folding of leaves in the bud in a longitudinal direction along the midvein, the upper surface being folded in, as in very many plants.

Condurango. S. American shrubby vines, especially the *Gonolobus condurango*, the bark of which was at one time reputed to be specifics in the treatment of cancer, but soon found to be useless save as tonics.

Condylarthra. Sub-order of *Taxeopoda*, comprising fossil sub-ungulate mammals that present generalized characters, so that the group may be considered as ancestral to all the Ungulates. The affinities are close with the *Bunotheria*, Marsupials, Lemurs, and on the ungulate side with the *Hyracoidea*, *Proboscidea*, etc. The toes were furnished with nails.

Condylopod. Articulated animal or anthropod.

Condy's Liquid. Disinfectant made by dissolving permanganate of potassium in water.

Cone. Solid bounded by a conical and a plane surface, or by a conical and two parallel plane surfaces. The fixed point of the conical surface is the vertex; the parts on each side of it are the upper and the lower nappes; the plane surfaces are upper and lower bases. Ordinarily but one nappe and one base are considered. Cones are classified as circular, elliptical, etc., according to their conical surfaces. They are right or oblique, as the axis makes a right or oblique angle with the plane of the base.

Cone. In Botany, a multiple fruit, resulting from the ripening of the scaly catkins of certain plants, especially those of the Pine family; also termed Strobile.

Cone-Flower. Plants of the genus *Rudbeckia* of the Composite family, natives of N. America.

Cone-in-Cone. Singular concretion seen in some argillaceous strata, having lines of apparent structure arranged in conical or trumpet-shaped forms in several series, which seem to be associated in nests. Its origin is unknown. Some attribute it to a chemical, others to an organic, cause.

Cone Pulleys. In machine tools operating by rotary motion of tool or work, to preserve a uniform speed of cutting at the periphery of circles of varying radius, there must be provision to vary the number of revolutions of the driving spindle of the tool. In belt-driven tools, this is done by having pulleys of different diameters on the driving shaft, with a complementary series or nest on the shaft of the tool. The same belt may be made to drive from a large pulley to a small one at one extreme, and from a small to a large one at the other extreme, with intermediate steps and velocities. For a crossed belt between the two shafts, the tension of the belt on any pair of pulleys of the cone will be constant if the sum of the radii of the two pulleys in any pair is constant; for the open belt, the steps are computed from the half sum and half difference of the pulleys on each side of the one being calculated.

Coney. Biblical name for Hyrax. See HYRACOIDEA.—Also a Rabbit.

Coney Island. Summer resort at w. end of Long Island, 10 m. from N. Y. City; 5 m. long by ½ m. wide. It has many hotels, concert halls, etc., and the safest beach for bathing on the coast.

Confederacy, SOUTHERN. The convention of S. Carolina declared that State no longer in the Union Dec. 20, 1860. Before Lincoln's inauguration, March 4, 1861, 7 States had seceded. The Confederacy was formed by convention of delegates from seceding States at Montgomery, Ala., Feb. 4, 1861; Jefferson Davis was elected Pres. Feb. 18. The Confederate Congress authorized a force of 100,000 men March 6. Letters of marque and reprisal against commerce of U. S. were granted May 17. A war of four years ended with the fall of Richmond April 3, 1865, and the surrender of the Southern armies within the few weeks following.

Confederation, ARTICLES OF. Adopted by Congress July 9, 1778, but not ratified by all the States till March 1, 1781; in force until the adoption of the Constitution 1789.

Confederation of Bar. See BAR and PULASKI.

Confederation of the Rhine. Formed at Paris, July 12, 1806, by 16 German princes who renounced their connection with the Germanic Empire, and placed themselves under the protection of Napoleon. It covered 125,000 sq. m., with a pop. of 14,600,000 and an army of 119,000, but went to pieces 1813.

Conference. Various Christian assemblies, especially the governing bodies of Methodists, principally consisting of the traveling preachers. Deputies from the annual conferences form the quadrennial M. E. General Conference.

Conferruminate. Cotyledons united into a single mass, as in the Horse Chestnut.

Confervoideæ. Division of green Algæ, comprising many of the smaller species, both fresh water and marine.

Confession. Acknowledgment of a criminal act. It is judicial when made in open court, *i.e.*, by a plea of guilty; extra-judicial when made out of court, voluntarily, *i.e.*, not prompted by improper threat or promise.

Confession. Private avowal of one's sins to a priest, prior to absolution; prescribed by R. C. and Greek Churches, and practiced by some extreme Anglicans; repudiated by most Protestants. The Prayer Book services include a form of general and public confession.

Confession of Faith. Formal and authoritative state-

ment of denominational tenets, as the Augsburg, the Westminster, the 39 Articles.

Confirmation. Among various Protestants a rite, among Catholics a sacrament, admitting to full church standing; with Anglicans and Romanists given exclusively by the bishop, with Greeks by priests.

Confiscation. Appropriation of private property to public use, by laws of war, or in punishment of treason or other crimes.

Conflans. Town of France, where a treaty was signed Oct. 9, 1465, between Louis XI. and the Dukes of Bourbon, Brittany and Burgundy, ceding Normandy to the Duke of Berry.

Conflict of Duties. Arising where there is need to choose between two actions, each of which is apparently a violation of some maxim or principle of morality; especially when the preservation of life or honor of another dependent on us can be accomplished only by violating some moral law.

Conflict of Laws. Branch of jurisprudence which deals with the rules governing the transactions or contracts between foreign states or their citizens. It is a fundamental principle that all persons and property within a State are subject to its laws. Another rule is that a State's laws have no force beyond its domain, except such as other States voluntarily accord them.

Confocal. Having coincident foci.

Conformable. Strata that lie parallel to one another.

Confucius, or KONG-FU-TSE, 551–478 B.C. Chinese sage, organizer, on an ancestral basis, of the prevailing well-knit

Image of Confucius, Canton.

and secularistic system of Chinese ethics, both individual, social, and civil.

Confucianism. Belief of the Chinese literati, including also the State religion. The Chinese name for the first of the Sáu Kiau, or three sects, is Ju Kiáu, or Sect of the Learned, commonly called Confucianists by foreigners, because all its members and priests are learned men, who venerate the classical writings. It includes those who adopt the writings of Confucius and Chu Hí and their disciples, and is not properly a sect. The word Ju denotes one of the Literati, and was adopted 1150 as a name of those who followed the speculations of Chu Hí regarding the Tai Kih, or "Great Extreme." This author's comments on the classics and his metaphysical writings have had a greater influence upon his countrymen than any other except Confucius and Mencius, whose works are received according to his explanation. The remarks of Confucius on religious subjects were few; he never taught the duty of man to any higher power than the head of the State or family, though he supposed himself commissioned by Heaven to restore the doctrines and usages of the ancient kings. He professed to understand little about the gods, who were above the comprehension of men. Chu Hí resolved the references to Shàng Tí in the *Shu King* to pure materialism, making Nature begin with the Tai Kih, which, operating upon itself, resolved itself into the dual powers, the Yang and Yin.

Of all the saints in the calendar of the Ju Kiau, Confucius is the chief; with him are reckoned the early kings Yao and Shun, with King Wan and his two sons, King Wu and Duke Chau. The memory of the philosopher was venerated; his teachings were handed down by his disciples; but it was not until nearly 300 years after his death that recognition was accorded his memory by imperial command. A single tablet is usually erected in his honor where he is worshiped; to carve images for the cult of the sage is uncommon. Official Chinese records enumerate 1,560 temples dedicated to him in the examination halls, where he is invariably worshiped. Incense is burned before his tablet with that of the God of Letters in all schoolhouses. The sacred books of Confucianism comprise the "Five Classics" and the "Four Books," the latter an abbreviation for "The Books of the Four Philosophers." See CHINESE LITERATURE.

Congé d'élire. In England, royal leave, given to a cathedral Dean and Chapter, to elect a certain person, and no other, Bishop, under heavy penalties if contravened; now meaningless.

Congelation. Process of changing from the liquid to the solid state by the loss of heat.

Congeneric. Plants or animals of the same genus.

Congenital Acquirements. Characteristics arising at or before birth.

Congenital Transmission. Used as equivalent of hereditary transmission, from which it is to be distinguished; *e.g.*, congenital disease is due to germs present in the mother, that have infected the fœtus.

Congenital Variation. Change in the characters of an animal arising from forces active at impregnation or in early embryonic life. See HEREDITY.

Conger Eel. See APODES.

Congestion. Increase in the amount of blood in a part or organ, which, if of sufficient extent, interferes with its functions. It rarely exists except as a symptom of disease and always precedes inflammation, but is not necessarily followed by it.

Conglomerate. Rock, often called Pudding-stone; made of pebbles cemented by calcareous, siliceous, or ferruginous mineral substances.

Congo. River of Central Africa. It rises in Lake Bangweolo and under the name of Lualaba flows n. across the equator. Bearing around to the w. and then s.w., it recrosses the equator and flows into the Atlantic. Its length is estimated at 2,900 m., its drainage area at 860,000 sq. m., its average volume at 1,800,000 cubic ft. per second, and the entire navigable parts of the river and its branches at 3,000 m.

Congo Free State. Embryo state of Central Africa, comprising a large part of the drainage area of the Congo River. Settlements have been made in this region under the auspices of the King of Belgium; the government, organized 1885, has been recognized by the leading powers of Europe and by the U. S. Area ab. 900,000 sq. m. Its native pop. is estimated at 14,000,000. Its European pop. is small.

Congo Red. $C_{32}H_{22}N_6O_6S_2Na_2$. Sodium salt of the compound, produced by the action of diazobenzidine on naphthionic acid; red powder, which dyes cotton a brilliant red without a mordant.

Congregationalism. That ecclesiastical polity which regards plenary authority as vested by Christ in the brotherhood of each particular congregation; distinguished from independency by requiring the concurrence of neighboring churches for the full regularity of certain capital acts. American Congregationalists number above 500,000, with more than 4,800 churches and 4,600 ministers.

Congregation of Cardinals. Committee assisted by Consultors, and intrusted with some branch of church administration, such as Doctrine, Rites, or Missions.

Congress, COLONIAL. Deputies from 9 colonies, who met in N. Y., Oct. 7, 1765, to consult for the general safety. They drew up a Declaration of Rights, a petition to the king, and memorials to Parliament.

Congress, CONTINENTAL. The First met in Phila., Sept. 5, 1774, with all the Colonies represented but Georgia; agreed on a second Declaration of Rights, a petition to the king, and addresses to the people of Great Britain and Canada. The Second met May 10, 1775, sent a last petition to the king, assumed the authority of a general government, and appointed Washington commander-in-chief.

Congress of Geologists. Consisting of several committees appointed from as many nations. It meets triennially to consider some geological matters of general interest and importance. Nomenclature and cartography have thus far received the chief attention. Meetings have been held at Paris 1878, Bologna 1881, Berlin 1885, London 1888, Washington 1891, and Zurich 1894. A geological map of Europe is expected to be pub. in 1895, under the auspices of the Congress.

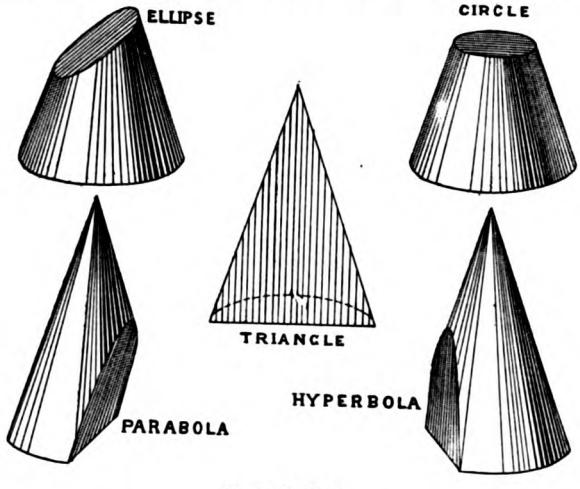
Congress of the United States. The legislative body of the U. S. consists of a Senate and House of Representatives collectively called Congress. The Senate consists of two members from each State chosen by the State Legislatures for 6 years. The Vice-President of U. S. is its presiding officer. The Senate has power to ratify or reject all foreign treaties made by the President and to confirm or reject his official appointments in addition to its legislative capacity. It may also constitute a High Court of Impeachment. The House of Representatives consists of members elected every second year by voters qualified by the laws of their respective States. Every 10 years a census is taken to determine the number of members to which each State is entitled. By that of 1890 the total was 356, or one representative to every 173,900 inhabitants. Each House is the judge of the elections, returns and qualifications of its own members, and may expel a member by a two-thirds majority. Each Member of Congress receives $5,000 per annum, 20 cents a mile for traveling expenses to and from his home, and $125 per annum for stationery. No person can hold any office under the U. S. and at the same time be a member of either House. A delegate is admitted from each organized Territory, who has the right to speak but not to vote; he is elected in the same manner as the others. The House elects its presiding officer, called the Speaker, who also appoints the Committees. Congress may propose alterations of the Constitution and has authority over Federal taxation, foreign affairs, army, navy, and, to a certain extent, militia, commerce, postal service, coinage, weights and measures, and the trial and punishment of crime against the U. S.

Congreve, RICHARD, b. 1818. English essayist, ed. Aristotle's *Politics*, 1855. Positivist *Catechism*, 1858.

Congreve, WILLIAM, 1670-1729. English dramatist. His most noted plays are *The Mourning Bride*, a tragedy, 1697, and two comedies, *The Old Bachelor*, 1691, and *Love for Love*, 1695. Another, *Way of the World*, 1697, though it failed, is by some considered his best.

Congruous. Two quantities are congruous in reference to a third when their difference is exactly divisible by the third. a and b are congruous to m, when $\frac{a-b}{m}$ is integral.

Conic, GEOMETRICALLY. Locus of the intersection of a circular right cone by a plane. This locus will be a circle, ellipse, parabola, hyperbola, as the inclination of the plane to the axis of the cone is a right angle, greater than the inclination of an element to the axis, equal to it, or less than it. Limiting forms of conics are a point, a straight line, two intersecting straignt lines.—ANALYTICALLY. A curve the distances of any point of which from a fixed point and a fixed line are in a given ratio. If this ratio = 1, the curve is a Parabola; < 1, an Ellipse; > 1, an Hyperbola; if the line distance is infinite, the curve is a circle; if the point distance is infinite, or if the point is on the fixed line, the curve is a straight line.



Conic Sections.

Conical. Roots of the carrot, etc., which are inverted cones.

Conical Surface. Produced by an indefinite straight line revolving on a fixed point and in contact with a given curve called the directrix. The common conical surface has a circle for directrix.

Conidiophore. Filament of the mycelium of *Fungi*, which bears conidia or conidiospores.

Conidiospores. Asexual organs of propagation, borne on special branches of the thallus or mycelium of certain *Fungi;* known also as Conidia.

Coniferæ. Natural family of flowering plants of the class *Gymnospermæ*, comprising 34 genera and ab. 300 species, widely distributed through the temperate and mountainous regions of both hemispheres; seldom found in the tropics; commonly called the Pine family.

Coniferin. $C_{16}H_{22}O_8+2H_2O$. Mpt. 185° C. Glucoside, found in the sap of numerous conifers; white crystalline solid, which breaks up into glucose and coniferyl alcohol. Vanillin is prepared from the alcohol.

Coniine. $C_8H_{17}N$. Bpt. 167° C. Pyridine derivative, poisonous principle of *Conium maculatum*. Liquid of stupefying odor. Basic in its properties. It paralyzes the motor nerves.

Conington, JOHN, 1825–1869. Prof. Oxford 1854; ed. Virgil, 1861–68; tr. Horace, 1863–69; Virgil, 1866–72; and the *Iliad*, 1868.

Coniomycetes. Division of *Fungi*, including many of the minute forms which infest living plants; often destructive to crops; popularly known as Rust and Smut.

Conirostral Beak. Conical, like that of Crows and Finches.

Conirostres. Tribe of Passerine birds, with thick head, powerful conical beak, short neck, and ambulatory feet. The metatarsus is short and covered with scales in front. They feed principally on seeds and fruits. The Larks and Finches (*Alaudidæ* and *Fringillidæ*), including the Bunting, Sparrow, Canary, and Crossbill, are examples. The last has the conirostral character much obscured, by the crossing of the tips of its beak, to enable it to feed on the seeds of fir-cones, which it tears to pieces. The Weaver-bird also belongs to the group, and some authors include many of the Dentirostres, in which the notch of the upper beak is weak, as the Crows, Starlings, and Birds of Paradise. The Levirostral Hornbills are also sometimes placed here.

Conium. Fruit of the *C. maculatum*, supposed to be the

Conium maculatum.

hemlock with which the Athenians executed criminals; highly poisonous; used in medicine in spasmodic diseases.

Coni Vasculosi. See VASA EFFERENTIA.

Conjugatæ. Order of *Algæ*, including both unicellular and multicellular kinds, reproduced by the sexual process of conjugation.

Conjugate. Quantities, geometric or algebraic, differing in direction or position, but connected by common elements of structure or reference.

Conjugate Cones. Having their axes at right angles and the elements in the plane of the axes coincident.

Conjugate Diameters. Each parallel to the tangents through the extremities of the other.

Conjugate Foci. Any two points on the axis of any converging or diverging optical system, so related that if the source of light be at either the rays after reflection or refraction will be concurrent at the other.

Conjugate Hyperbolas. Those having transverse and conjugate axis interchanged in value and position.

Conjugate Pairs OF IMAGINARY ROOTS. Of $(\chi)=0$ have the form $a\pm\sqrt{-}b$.

Conjugate Planes. Three planes (in a surface of the second order) when each bisects the chord of surface parallel to the other two.

Conjugate Points. Similarly situated in reference to a fixed point or line, but in opposite direction.

Conjugation. Fusion of two cells into one, which is thus enabled to reproduce itself with renewed vigor. This is the primitive form of fertilization; the ovum and spermatozoön are supposed to have differentiated from such cells. It is sometimes erroneously termed copulation, which implies only temporary apposition of cells for purposes of mutual transfer of impregnating substance. Among the ciliated Infusoria, such copulation is accompanied by peculiar karyokinetic phenomena, which consist of: (1) the breaking down of the endoplast; (2) the multiplication of the endoplastule to four nucleoli; (3) the mutual passing of one of these to the other cell; (4) the conjugation of the new comer with one of the stay-at-home nucleoli to make a new nucleolus; (5) the conjugation of the other two nucleoli to make a new nucleus (endoplast). Several variations of this process have been reported. In *Colpidium truncatum*, after the nucleolus (micronucleus) splits into four, all are thrown out but one, which again divides into a stay-at-home and an emigrant. The immigrant conjugates with the stay-at-home, to form a "combination" nucleus in each cell, and this splits into micro- and macro-portions. The evidence, so far as we have it, does not warrant of a single formula for all cases.—In Botany, process of reproduction in certain of the lower plants, consisting in the coalescence of the protoplasm from two cells, either of the same or of different individuals, forming a zygosperm.

Conjunction. Agreement of two heavenly bodies in Longitude or Right Ascension.

Conjunctions. Indeclinable words, used to connect words or phrases, and derived from other forms like adverbs or pronouns; thus *or* is contracted from *other; that* is really the pronoun. Some conjunctions are really compounds, evident, like *because*, or concealed, like *but* from *be-ûtan*.

Conjunctiva. Mucous membrane which lines the eyelids and covers the visible portion of the eye, the cornea excepted; when inflamed the condition is known as Conjunctivitis.

Conjunctur. General condition of the industrial environment at any time.

Conkling, ROSCOE, 1829–1888. M. C. 1859–63, 1865–67; U. S. Senator from N. Y. 1867–1881; Republican leader.

Connaraceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 14 genera and ab. 170 species, distributed through the tropical regions of both hemispheres.

Connate. Opposite leaves which are united by their bases into a single foliaceous structure, as in Boneset and the Trumpet Honeysuckle.

Connecticut. One of the n. e. of the U. S. of America. Its area is 4.990 sq. m. Its surface is undulating and hilly, especially in the n. w. part, the minor features being formed of glacial deposits. Its principal rivers are the Thames, Connecticut and Housatonic, all of which are navigable for considerable distances. The State has ample water power in its numerous small streams, which is utilized in its extensive manufactures. The surface rocks are Archæan, with the exception of the Connecticut Valley, in which is found a belt of Triassic extending down from Mass. Its industries are mainly manufacturing. Agriculture still has considerable importance, although it is disappearing. The region was explored by the Dutch 1620 and a settlement made 1633 on the site of Hartford, which was soon sold to the Puritans. In 1637 several towns had been settled with independent governments, and the Pequot Indians had been met and defeated. In 1662 a new charter was granted by Charles II. to John Winthrop, which united all the settlements under one government, New Haven alone standing out for a time. This charter was so liberal that no changes were needed when Conn. became an American State. James II. sought to revoke all the New England charters, but when his governor, Sir Edmund Andros, demanded that of Conn., it was refused and could not be found; it was supposed to have been concealed in the famous Charter Oak. Hartford was the seat of government until 1701, when New Haven was made the second capital, the government convening in each place alternately until 1874, when Hartford again became the capital. The pop. in 1890 was 746,258. (See Map on page 346.)

Connecticut River. It heads in n. New Hampshire, and flows s., forming the boundary between N. H. and Vt., then across Mass. and Conn. It is navigable to Hartford. Length ab. 450 m., drainage area 11,269 sq. m.

Connecting Rod. Link which connects a revolving crank pin to a reciprocating cross-head or an oscillating beam in an engine. The crank end will always have a single eye, but the other end may be forked to have a double bearing. This is to be avoided when possible, as it is difficult to make the rod swing true. To enable wear to be taken up easily at the pins, each end of the rod has a STUB-END (q.v.) with brasses. When a connecting-rod comes from a beam to a shaft or other working piece, it has been called a pitman, since in the earlier beam engines for mine pumps this connecting rod passed down into the mine pit. Newer connecting rods are made of steel. In locomotives the connecting is often called the main rod, to distinguish it from the side or parallel rods, which couple the driving wheels together.

Connective. Tissue which connects the two sacs of the anther; commonly formed of a prolongation of the filament.

Connective Tissue. That which binds together and supports the various organs and elements of the body.

Connubium. United masses of protoplasm in the reproductive process of conjugation.

Conodonts. Minute, glistening, slender, conical bodies found in the Lower Silurian rocks; probably the jaws of Annelids. These have been taken by some palæontologists for the teeth of fishes, an opinion now generally abandoned.

Conoid. (1) Solid formed by revolving any conic about its axis; genus embracing parabaloids, spheroids, etc. (2) Warped surface formed by a straight line so moving as to constantly touch a fixed straight line and a fixed curve while remaining parallel to a fixed plane.

Conomedusæ. See CHARYBDEIDÆ.

Conon. Athenian general in Peloponnesian war; defeated at Ægospotami 405 B. C.; victorious over the Spartans off Cnidus 394.

Conquest, RIGHT OF. The right which belongs to a State to bring under its sovereignty the whole or part of another state by virtue of the right of war.

Conrad. I. German emperor 911–918.—II. Duke of Franconia, Emperor 1024–39, King of Italy 1026, and of Burgundy 1032.—III., 1093–1152; Emperor 1138; leader of the Second Crusade 1147–49.—IV., 1228–1254; son of Frederic II.; King of Rome 1237, Emperor 1250.—His son, CONRADIN, 1252–1268, the last Hohenstaufen, was defeated and executed in Italy.

Conrad, ROBERT TAYLOR, 1810–1858. American poet; mayor of Phila. 1854, and twice judge. His *Aylmere* was a successful play.

Conrad, TIMOTHY ABBOT, 1803–1877. Palæontologist to the Geological Survey of New York 1838–41. His later work among the American Tertiary fossils made him the pioneer in that department.

Conrad of Wurzburg, d. 1287. German lyric and epic poet.

Consalvi, ERCOLE, 1757–1824. Cardinal, and papal Sec. of State.

Consanguinity. Connection between blood relatives; lineal, between an ancestor and descendant; collateral, between those descended from a common ancestor.

Conscience. Faculty which serves as a repository of ideas of right and wrong, and judges of the rightfulness or wrongfulness of individual actions according to some accepted moral standard, intuitive or derived.

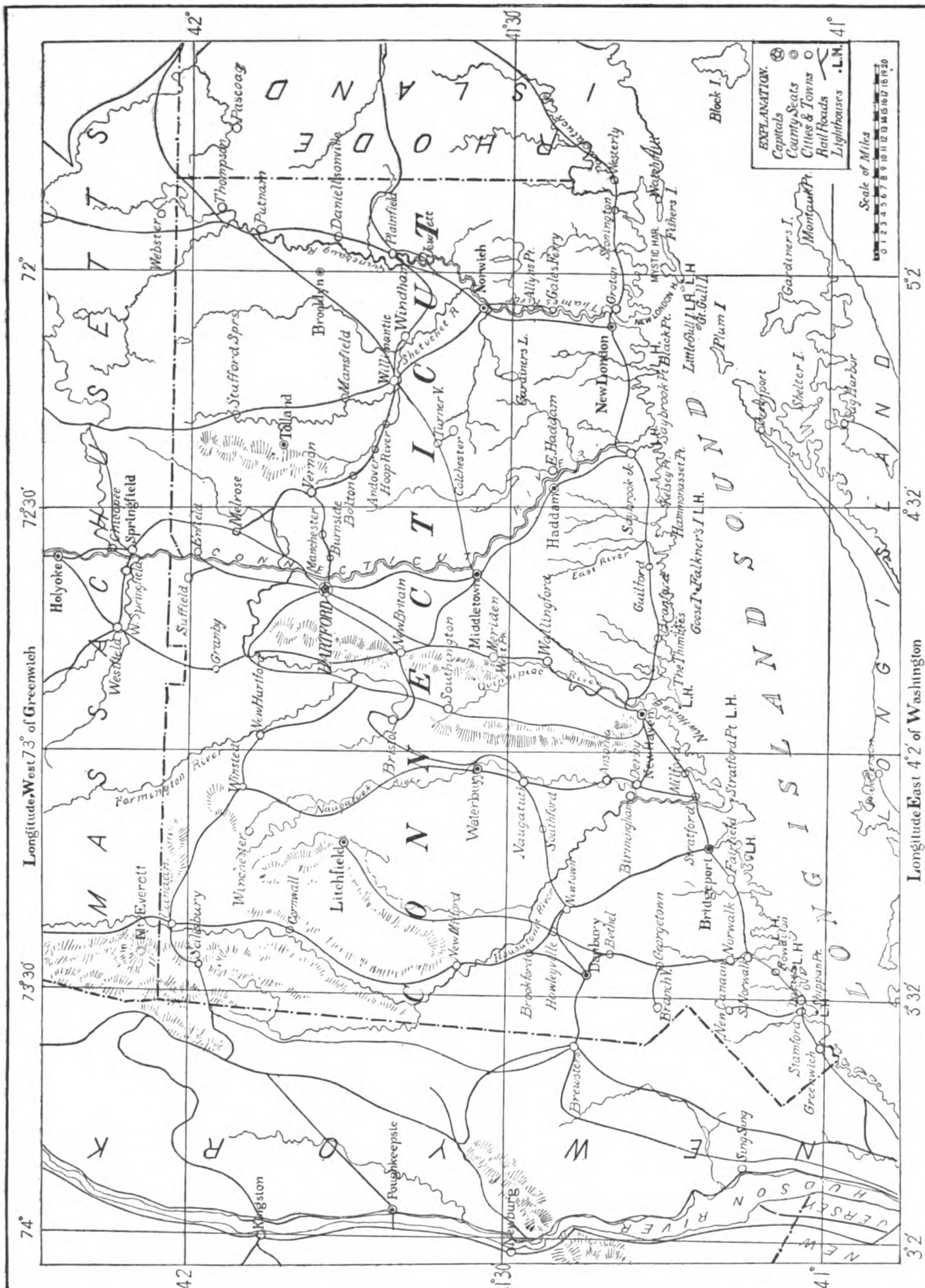
Conscience, HENRI, 1812–1883. Flemish poet and novelist, noted for his pictures of rural life in Belgium. *Lion of Flanders*, 1838; *Jacob van Artevelde*, 1849; *History of Belgium*, 1845. He rose from a humble station to great repute at home, and some of his works were extensively translated.

Conscience Money. Payments made usually anonymously to the government by people who have defrauded the customs or evaded taxes and whose conscience prompts them to restitution. Considerable sums are paid into the Treasury in this manner every year, both in England and the U. S.; in the former, amounting to £51,375 from 1873 to 1880 inclusive, and in the latter to $74.973.22 from 1881 to 1891 inclusive.

Consciousness. That peculiarity of at least the higher forms of organic life by which they become aware first of facts affecting them and then of themselves as experiencing these facts.

Conscript Fathers. Senators of Rome; originally *Patres et Conscripti*, the former being patricians, the latter those of equestrian rank enrolled with them 509 B.C.

Conscription. Compulsory enrollment in an army; begun in France 1789, in Prussia 1813.


Longitude West 73° of Greenwich
Longitude East 4° 2' of Washington
EXPLANATION.
Capitals
County Seats
Cities & Towns
Rail Roads
Lighthouses
Scale of Miles
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
74°
73°30'
72°30'
72°
42°
41°30'
41°
3°2'
3°32'
4°32'
5°2'
MASSACHUSETTS
RHODE ISLAND
CONNECTICUT
NEW YORK
NEW JERSEY
LONG ISLAND
LONG ISLAND SOUND
HUDSON RIVER
HARTFORD
Holyoke
Springfield
W. Springfield
Westfield
Chicopee
Suffield
Enfield
Granby
Melrose
Manchester
Burnside
Bolton
Vernon
Tolland
Stafford Sprs
Mansfield
Willimantic
Windham
Brooklyn
Danielsonville
Putnam
Thompson
Pascoag
Webster
Plainfield
Jewett
Norwich
Allyns Pt.
Gales Ferry
Groton
New London
Stonington
Westerly
Watch Hill
Fishers I.
Mystic Har.
New London H.
Block I.
Montauk Pt.
Gardiners I.
Plum I
Gt. Gull I.
Little Gull I. L.H.
Black Pt.
Saybrook Pt.
Kelsey Pt.
Hammonasset Pt.
Falkner's I L.H.
Goose I.
The Thimbles
Branford
Guilford
Saybrook Jc.
Haddam
E. Haddam
Gardiners L.
Colchester
Turner V.
Andover
Hoop River
Middletown
Meriden
West Pk.
Wallingford
East River
Quinnipiac River
New Britain
Southington
Bristol
New Hartford
Winsted
Farmington River
Naugatuck River
Winchester
Litchfield
Cornwall
Canaan
Salisbury
Mt. Everett
New Milford
Waterbury
Naugatuck
Southford
Ansonia
Derby
Birmingham
New Haven
Milford
Stratford
Stratford Pt L.H.
Bridgeport
Fairfield
Newtown
Housatonic River
Brookfield
Hawleyville
Danbury
Bethel
Georgetown
Branchville
Norwalk
S. Norwalk
New Canaan
Rowayton
Stamford
Shippan Pt.
Greenwich
Brewsters
Sing Sing
Newburg
Poughkeepsie
Kingston
Sag Harbor
Shelter I.
Greenport

Consecration. Act of dedicating, setting apart for God's service; applied chiefly to the eucharistic elements, church buildings, and bishops.

Consecutive Elements. Those in a continuous development having no intermediate values or positions.

Conseils des Prud'hommes. Tribunals established by law in France and Belgium for speedy and inexpensive settlement of certain specified industrial disputes, and for the execution of certain trade laws.

Consequences. Game played by any number of persons with pencil and paper. They sit around a table, and each writes at the top of his paper an adjective descriptive of a man. He then folds it over the word and passes it to the next, who writes under the hidden word the name of a historical character or of some acquaintance. These words are followed in turn by an adjective describing a woman; then a woman's name; then where the man and woman met; what he said; what she said; and finally what the consequences were. The papers are then mixed upon the table; each player draws one, and reads it aloud in turn, amusement being derived from the incongruities of the compositions.

Consequent. Second term of a geometrical ratio.

Consequent Points. Intermediate magnetic poles sometimes developed along a magnetic bar, by some peculiarity in the structure of the bar or irregularity in the magnetizing process.

Conserta. See THALIACEA.

Conservation of Areas. If a system of particles be subject only to mutual actions, the sum of the products of the mass of every particle into the projection (on any proposed plane) of the area described by its radius vector round any assigned point is proportional to the time. This principle was discovered about the same time by Euler, Daniel Bernoulli and D'Arcy. Newton's theorem respecting the areas described by a single body about a center of force is a special case.

Conservation of Energy. If a system of bodies have a certain amount of energy it must retain this unchanged in amount, no matter through what internal changes the system passes. If the system include the whole universe, the principle asserts that the whole amount of energy in the universe is invariable and numerically constant.

Conservation of Matter. The total quantity of matter in the universe is constant, and existing matter cannot be destroyed or new matter created.

Conservative System. System of bodies so related that if any stress be set up between them, depending upon the configuration only, and not at all upon the conditions of the existence of such a configuration, the system will tend when work has been done upon it to return to its original form and to restore the work done. If it be so related to surrounding objects that this is impossible it will remain under a condition of stress.

Conservatoire. Institution originated by the Italians in the 4th or 5th century for the advancement of music, those of Naples and Venice being the most famous. France founded the Conservatoire de Musique with an income of 240,000 fr. and 125 masters in 1793, and among its famous directors were Cherubini and Auber. The celebrated Leipzig Conservatorium was established under Mendelssohn 1842, and Brussels, Prague, Vienna, Cologne, Munich, Stuttgart, Berlin, London, Boston, New York and Cincinnati have similar institutions.

Conservatory. Greenhouse where plants are kept through the winter, or exotics are cultivated; a glass-house for forcing fruit, flowers and vegetables under artificial heat.

Consideration. Compensation for services performed, or inducement to an undertaking; a material motive of action. It usually takes the form of a contract, since promises unaccompanied by a consideration cannot as a rule be enforced by law.

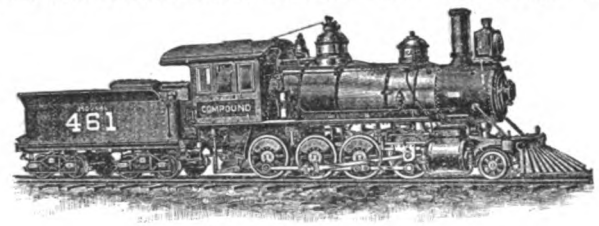
Consilia Evangelica, or COUNSELS OF PERFECTION. Points of self-denial, especially celibacy and voluntary poverty, approved by the Roman and Greek churches as a more eminent way of salvation for such as feel equal to them.

Consistory. In Rome, the pope's council of cardinals; in England, a bishop's court; in Lutheran Germany, a clerical and lay board exercising powers; in the Reformed churches of the U. S., the lowest court.

Consolato del Mare. Code of law adopted by the nations navigating the Mediterranean during the 14th century. Based upon Roman law, it is the foundation of modern maritime law and regulates international naval matters both in peace and war.

Console. Projecting horizontal bracket or corbel of masonry, tapering from the wall outward, and having a volute at each end.

Consolidation Locomotive. One having eight driving wheels: introduced on Lehigh Valley Railroad 1864; now used for freight service on steep grades.



Consolidation Locomotive.

Consols. Various stocks and bonds issued by the British Government were massed into one fund by the Consolidated Annuities Act of 1750 which became corrupted into Consols. They constitute the greater part of the funded debt, which now (1894) amounts to £587,631,096.

Consonance. Harmonious blending of sounds. Its degree depends on the complexity of the combination and on the ability of the ear to analyze the resultant tone into its components. Thus the dividing line between consonance and dissonance is not at all clearly defined, since both conditions rest upon the physiological action of the organism.

Consonant. Division of spoken sounds, based not on their nature, but on their function; really an associated sound; thus in *an*, *a* is vowel or sonant, and *n* is consonant. In the second syllable, however, of words like *little*, the consonant has vowel functions. Consonants are classified according to the way in which the stream of breath is modified by the organs of the mouth (see VOWEL). If this stream be completely checked, there result the mutes or stops—*b*, *d*, *g*, *p*, *t*, *k*; if only partially checked, frications—*f*, *v*, *s*, *z*, *th*; while *l*, *r*, *m*, *n* are so near the unchecked character of vowels that they are often called semi-vowels. Consonants are further divided according to the vocal organs which aid in forming the sound: labials, *p*, *b*, *f*, *v*; dentals or linguals, *t*, *d*, *th* (as in *thin*), *th'* (as in *thine*), *s*, *z*; gutturals, *k*, *g*, *ch* (German), etc. Finally consonants are surd (voiceless) or sonant (voiced) according to the passivity or activity of the larnyx and vocal chords; of the foregoing list, *p*, *t*, *k*, *f*, *s*, *th* (*thin*), are surds, *b*, *d*, *g*, *v*, *z*, *th'* (*thine*) are sonant.

Consort. One married to a reigning sovereign. Queen-consort differs from queen-regnant in that the latter rules in her own right. The consort has no share in the government. Prince Consort was the title given to Queen Victoria's husband in 1857.

Consortism. See SYMBIOSIS.

Conspiracy. Agreement between several persons to do an unlawful act, or to do a lawful act by unlawful means. The gist of the common law offense is the unlawful combination. Modern statutes often require in addition an overt act toward the accomplishment of the object. Damage must follow the combination in order to give the person aimed at a civil action.

Constable. In modern law, a local officer charged with keeping the peace, and authorized to arrest offenders and to serve process.

Constable, HENRY, 1562–1613. English poet. *Diana*, 1592–94.

Constable, JOHN, 1776–1837. English landscape painter, most esteemed in France, where he had important influence on Theodore Rousseau and others. Two fine examples are in the N. Y. Met. Museum. His *Rainbow* and *Weymouth Bay* are in the Louvre; fine works are in the National Gallery of London.

Constance, COUNCIL OF. 1414–18; regarded in R. C. Ch. as 17th General Council. It burned Huss and Jerome of Prague, deposed Pope John XXIII. and his two rivals, procured the election of Martin V., and ended the great schism.

Constance, LAKE, or BODENSEE. N. e. of Switzerland; ab. 44 m. by 9; average depth 490 ft. The Rhine passes through it.

Constance, PEACE OF. 1183, between Frederic I. and the Lombard League.

Constans, FLAVIUS JULIUS. ab. 320–350. Youngest of Constantine's sons; ruler of Illyricum, Italy and Africa 337; Emperor of the West 340.

Constans, JEAN ANTOINE ERNEST, b. 1833. French statesman; Minister of the Interior 1880–82 and 1889–92; Envoy to China 1885–87; Senator 1889.

Constant. Quantity unchanged throughout any discussion or in any specific locus: distinguished from Variable; classified as (1) absolute, admitting no change; (2) arbitrary, changed at will, subject to assumed or observed conditions; (3) undetermined, the specific value of which becomes known by mathematical reduction.

Constant, BENJAMIN, b. 1845. French subject painter.

Constant de Rebecque, HENRI BENJAMIN, 1767–1830. Swiss-French philosopher and publicist, exiled by Napoleon 1802, prominent in state affairs from 1815. *Constitutional Politics*, 4 v., 1817–20; *The Hundred Days*, 1820; *On Religion*, 5 v., 1824–31; *Letters and Diary*, 1894.

Constantine. City of e. Algeria, 40 m. from the sea; anciently Cirta, capital of Numidia; ruined ab. 310; rebuilt by C.; taken by Arabs 710, and by the French 1837. Pop., 1891, 46,581.

Constantine, FLAVIUS VALERIUS AURELIUS, 274–337. "The Great"; Roman Emperor 306; son of Constantius Chloras. He defeated Maxentius, who had seized Rome, Oct. 27, 312; defeated and dethroned Licinius, who had the dominion of the East, 323, and became sole Emperor; made Byzantium his capital and renamed it Constantinople; published several edicts in favor of Christians 321; convened the Council of Nicæa 325, and was baptized when near death.—His eldest surviving son, CONSTANTINE II., 316–340, inherited Gaul, Spain, and Britain.

Constantine I. Pope 708–715. II. 767–768.

Constantinople. Capital of Turkey, at the foot of the Bosphorus Strait, on an inlet which forms an excellent harbor, from its shape known as the Golden Horn. The site is hilly, the streets are crooked and irregular. It is strongly fortified.

Constantinople.

The ancient BYZANTIUM (q.v.), refounded by Constantine 324–330; enlarged by Justinian. It resisted many attacks of Saracens and Russians; was taken by the Latins 1204; recovered by the Greeks 1261; besieged by Amurath 1422, and taken by Mahomet II. 1453. Pop. ab. 930,000, half Turks and one-quarter Greeks.

Constantinople, COUNCILS OF. I., held 381, the 2d called œcumenical, confirmed the Nicene decrees of 325, and added particulars concerning the Holy Ghost.—II., the 5th, 553, condemned Justinian's edict of 544, called the 3 chapters.—III., the 6th, 680–81, condemned the Monothelites.—IV., the 8th, 869.

Constantinople, PATRIARCH OF. See GREEK CHURCH.

Constantius. I. FLAVIUS VALERIUS, called Chlorus, 250–306. Cæsar 292, governing Spain, Gaul, and Britain; Emperor 305; father of Constantine.—II. FLAVIUS JULIUS, 317–361; son of Constantine; ruler of Asia and Egypt 337, sole Emperor 350. —III. General of Honorius; Emperor of the West 421.

Constant Return, LAW OF. In economics, principle governing cases in which the addition of a certain amount of labor brings exactly proportionate return of product, instead of an increasing or diminishing proportion.

Constellation. Collection of stars whose outline is imagined to resemble some animal, bird, fish, or other object.

Constipation. Costiveness; condition in which fœces are retained longer than is normal, become hard and difficult of passage.

Constitution. U. S. vessel, called *Old Ironsides*, which vanquished the *Guerrière* off Gulf of St. Lawrence Aug. 19, 1812, the *Java* off coast of Brazil Dec. 29, 1812, the *Cyane* and *Levant* off Lisbon Feb. 20, 1815.

Constitutional Law. Body of rules regulating the distribution and exercise of governmental powers. In the U. S., its chief elements are the Federal and State constitutions, the statutes in accordance therewith, and the judicial decisions relating thereto. In Britain, it consists mainly of such written laws as Magna Charta, The Bill of Rights and The Act of Settlement, unwritten laws which are enforced by the courts, and those understandings and practices which are deemed binding, but not enforced by the courts. A striking feature of American court-law is the power given to the courts to declare duly enacted statutes void because in conflict with the written Constitution; another is the partition of the powers of sovereignty between the State and the Federal governments, so that each is sovereign within its sphere, the nation being "an indestructible union of indestructible States."

Constitution of the U. S. Framed by the convention of the representatives of the people, assembled in Phila. Sept. 17, 1787, and became a law the day it was ratified by Congress, March 4, 1789. During the War for Independence the Articles of Confederation served as a Constitution. The present Constitution consisted originally of 7 articles, but later on 15 amendments were added. In 1789–90, at the assembling of the First Congress, the first 10 amendments were proposed, the 11th 1798, the 12th 1804, the 13th 1865, the 14th 1868, the 15th 1870.

Constitutions of Clarendon. See CLARENDON.

Consubstantial. Of one or the same substance with the Father; epithet applied to Christ by orthodox theologians in the 4th and later centuries.

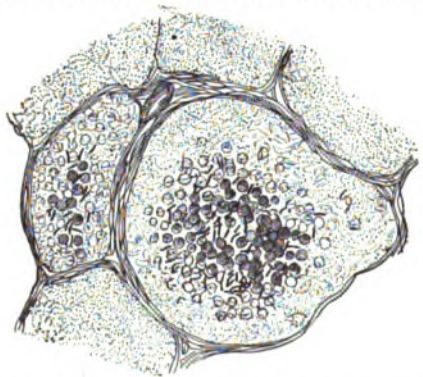
Consubstantiation. Popular name of Luther's doctrine, that in the Eucharist Christ is corporeally present with the elements *in usu*, being received with the mouth, even by the unworthy, though to their condemnation. The term was never accepted by Lutherans.

Consuls. (1) Two highest magistrates of the Roman Republic, chosen annually from 510 B. C., at first from the patricians only. The title was revived in the French Republic, lasting from Nov. 1799 to May 1804. (2) Commercial agents of one nation resident in another for the protection of the interests of traders, travelers and mariners of their nation. Ordinarily they have no diplomatic duties, and are subject to the laws and the jurisdiction of the state where they reside; by treaty they exercise jurisdiction over their countrymen in many Oriental states. Jurisdiction of all cases affecting foreign consuls in the U. S. is vested in the Federal Courts.

Consumer. In economics, the person whose economic function and interest is in the consumption of any specified commodities, rather than in their production.

Consumer's Rent. Excess of the price which a person would be willing to pay for a thing, rather than go without it, over the price which he really does pay.

Consumption. Disease of the lungs, in which there is destruction of their proper tissue with the formation of cavities, occurrence of hæmorrhage, cough, wasting, loss of strength, hectic fever and night sweats. Three forms are recognized, with no well-marked differences in the symptoms; in one the exciting cause is the *Bacillus tuberculosis;* in another, Caseous Consumption, the exudation of pneumonia or the secretion of bronchitis degenerate and soften, causing destruction of the lung tissue; in the third, Fibroid Consumption, there is a hyper-



From a section through a tubercle of the lung from a case of acute miliary tuberculosis in a child.
Several alveoli are seen filled with debris; in the center of this are numerous nuclei, and among them the tubercle-bacilli.
Magnifying power about 3.0.

trophy of the connective tissue and, as it were, a subsequent strangling of the proper pulmonary tissue. The two first are by far the most fatal, few recoveries occurring after the disease is fairly established; death supervenes usually within two years, often in less than one, then being known as quick, rapid, or Galloping Consumption, or Phthisis Florida. In the fibroid form the progress of the disease is slow and life may be

prolonged for years. Consumption is not hereditary, but a type of lung tissue particularly favorable to its development is inherited. It is more common in rapidly changeable climates, especially those which are damp with raw winds. It respects neither age nor sex, though more frequent before the age of thirty than later. It attacks those subjected to bad hygienic conditions, and those who follow up avocations in which large amounts of dust are given off. It often follows acute disease, such as measles, scarlet fever, or whooping-cough, is liable to develop in the badly nourished, especially those of a strumous tendency, and when due to the tubercle bacillus is distinctly contagious. This micro-organism is contained in the expectoration and diseased lung tissue, and when these are dry may be very widely disseminated; hence it is of the highest importance that they and all objects with which they come in contact should be disinfected as carefully as if the disease were of the most virulently contagious and epidemic type. It is generally agreed that each case of tubercular consumption is always the source of many others, and that, if complete isolation of all cases were possible, the disease would soon be a rarity. Cure occurs when the diseased portions of the lung are separated and expelled, a result possible only when the disease is recognized early enough and the patient subjected to the proper climatic and hygienic conditions. The various symptoms, such as cough, night sweats, etc., must receive the proper medical treatment, and as large amounts of cod liver oil taken as can be digested and assimilated. Hæmorrhages by themselves are rarely fatal except in the last stages, and are usually controlled by a recumbent position and considerable doses of ergot or common salt. The localities in the U. S. best adapted for consumptives are the Adirondacks, Colorado, California, New Mexico, and many inland points in the Southern States; but almost any locality is suitable in which there are no rapid changes of temperature or damp and chilling winds, and where proper food is procurable. Sufficient clothing must be worn, the living and sleeping apartments well ventilated, and the mind kept free from anxiety by whatever outdoor occupation is most agreeable to the patient.

Consumption Capital. That part of social capital which consists of stores of commodities provided for the sustenance of workers of all industrial grades.

Consumption of Wealth. Use of wealth previously produced; its destruction in the process of satisfying wants or in producing other wealth. In economic discussion it is synonymous with demand, and is usually treated as the fourth of the great divisions, the others being production, distribution and exchange.

Contact Deposit. Ore deposit accumulated in a space between rocks of different kinds, resembling a vein or bed; often rocks of igneous origin form one wall or both.

Contact, Order of. Dependent on the tendency to divergence at a point of contact; determined by a comparison of the successive differential coefficients, obtained from the loci under consideration.

Contact, Point of. Where two or more loci are coincident and have the same direction.

Contagious Diseases. Those which are communicated by one person to another by a morbific principle (contagium), formerly regarded as impalpable, but now demonstrated, with few exceptions, to be a micro-organism, each disease having its own particular species. They are transmitted by the entrance into the body, either with the food, or air breathed in, or by intentional or accidental inoculation of the micro-organisms or their spores. Small-pox, scarlet, typhus, puerperal and typhoid fevers, whooping cough, cow-pox, mumps, measles, diphtheria, cholera, yellow fever, hydrophobia, venereal diseases, plague, glanders and tuberculosis are the most common members of this class. Although the micro-organisms of all of the above have not been demonstrated there is every reason to be confident that they exist. To prevent spreading of these diseases the afflicted must be isolated until the infective stage has passed, all the excreta and objects in contact with them disinfected, as also the apartments in which they have been. Neglect of these precautions is in nearly all communities severely punished by law.

Contarini. Venetian family, which furnished many generals, statesmen, and scholars, and eight doges. Cardinal Gasparo, 1483–1542, was papal legate at the Diet of Ratisbon 1541.

Contemporaneity. In Geology it means that the organic succession was the same in the different regions or that the different systems occupy the same relative positions in the succession of systems, but does not necessarily mean that they were formed at the same time or continued the same length of time. See Homotaxis.

Contempt. Willfully disturbing a legislature or a court, or disobeying its rules. The right of either to punish for contempt is inherent; its extent and the mode of its exercise are generally determined in the U. S. by constitutional or statutory provisions.

Conti, Antonio, 1677–1748. Italian poet and dramatist.

Conti, Armand de Bourbon, Prince de, 1629–1666. French general, brother and opponent of the great Condé.—His son, Francois Louis, 1664–1709, was yet more eminent in war, especially in Hungary and Flanders.

Continent. Large body of land, distinguished from an island only by its size. Four continents are commonly recognized: the western, comprising North and South America; the eastern, comprising Europe, Asia and Africa; Australia; and the Antarctic continent. Their areas and mean heights, excepting the last, are thus given:

Western,	14,484,450 sq. m.	1,950 ft.
Eastern,	31,131,350 "	2,500 "
Australia,	3,014,050 "	805 "

The continents and their subdivisions are in most cases broadest at the n., tapering to points s. They are mainly in the n. hemisphere.

Continental Money. Bills of Credit issued by the Congress of the United Colonies during the War of American Independence. In 1775 $3,000,000 were issued. By 1780 the bills put forth amounted to $200,000,000, and one dollar in silver would purchase forty in paper. By 1781 they had lost all value, and much public evil and private suffering resulted. "Continental," in opposition to provincial or colonial.

Continental System. Napoleon's design for isolating England and cutting her off from all trade and communication with the continent of Europe. It began 1806 with the Berlin Decree prohibiting neutrals from holding any correspondence with Great Britain and declaring British merchandise lawful prize wherever found. Reprisals were made by which neutral commerce suffered and which led to the American War of 1812. Dread of Napoleon induced most of the nations of Europe to join the Continental System till Russia broke away in 1812 and French efforts to punish her met with such disastrous results.

Contingent. Accidental, dependent or conditioned.

Continuant. Determinant in which the elements without the principal diagonal and its bordering minor diagonals are all zero, and one of the bordering minor diagonals has its elements all negative unity, *e.g.*,

$$\begin{vmatrix} x_1 & y_1 & 0 & 0 \\ -1 & x_2 & y_2 & 0 \\ 0 & -1 & x_3 & y_3 \\ 0 & 0 & -1 & x_4 \end{vmatrix}$$

Continued Fraction. One in which the numerator is unity and the denominator an integer plus a repeated fraction. The fractional terms of the successive denominators are called "integral fractions." An approximating fraction of the first, second, third, or *nth* order is found by arbitrarily stopping at the first, second, or *nth* integral fraction. The value of the continued fraction lies between the values of the approximating fractions of two consecutive orders. Continued fractions are used in solving indeterminate equations of first degree in whole numbers, exponential equations, and numerical equations of higher degree.

Continued Lines. Intrenched lines of field fortifications when there are no breaks or openings save those required for the passage of troops to the front. Lines with intervals are detached works without other relation to each other than that of their mutually supporting fire over their adjacent intervals.

Continued Proportion. Series in which each term after the first is a mean proportional between the term preceding and that following.

Continuity. Absence of all breaks or interruptions in the existence of a thing; thus space and time are continuous.

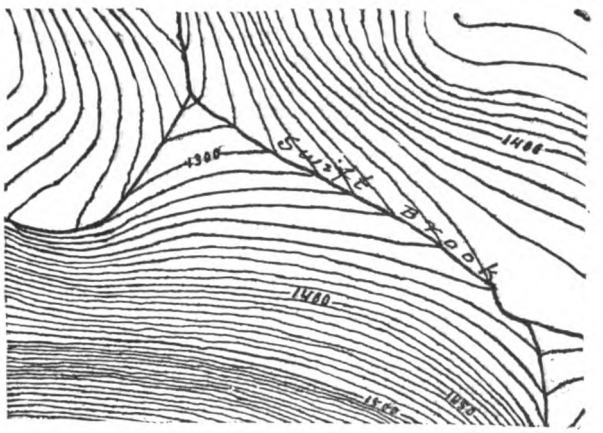
Continuous Beam or **Bridge.** Beam having more than two supports, or bridge having three or more piers, the chords of the bridge being unbroken over the piers. Continuous beams are of common use in structures, but continuous bridges have been but little built on account of the uncertainty of the stresses, caused by variations in the level of the piers. Drawbridges, however, are generally continuous. The Victoria

bridge at Montreal is formed of spans continuous over three supports. The Britannia tubular bridge has four continuous spans, two of 460 and two of 230 feet.

Continuous Function. Between two values, when it is real for all possible values between these.

Contour Feather. See PENNÆ.

Contour Lines. Lines drawn upon a map through points having the same elevation, and representing the lines that



Contour Lines.

would be cut out from the surface by parallel planes. Thus all points on the 1,300 and 1,400 feet contour lines are respectively 1,300 and 1,400 feet above the sea level or above the assumed datum plane.

Contraband of War. A belligerent has, by the principles of international law, a recognized right of preventing a neutral from furnishing to his enemy arms and munitions of war, or articles from which such munitions may be manufactured, and to confiscate them to his own use.

Contrabands. Negro slaves who had escaped from their masters and come within the lines of the Union army; so called by Gen. B. F. Butler at Fort Monroe 1861.

Contrabass. See DOUBLE BASS.

Contract. Agreement between persons by which one party is brought under legal obligation to the other. A formal contract depends for its validity upon its form, *e.g.*, a bond; a simple contract depends for validity upon the presence of a consideration, which is either some right, interest, or benefit, accruing to one party, or some detriment to the other. In addition to a form or consideration the parties must be capable of contracting, their assent to the terms must be mutual and real, and the object of the agreement must be legal. In express contracts the terms are put into words; in implied contracts the offer, or the acceptance, or both, are communicated by conduct.

Contracted Vein. Shape of a stream of water issuing from an orifice in a thin plate, its cross-section being ab. 62 per cent of that of the orifice; first measured by Newton. Its phenomena are important in practical hydraulics.

Contractile Vesicle. Vacuole in certain Protozoa which beats like a heart and discharges a fluid collected from the cell. It probably serves excretory and respiratory functions.

Contractility. Automatic power of change of form possessed by living protoplasm.

Contraction. Diminution in the existing supply of currency in any community, either absolute, or relative to the need for an increased amount of money.

Contraction of Rails. Under the range of temperatures in the U. S. a railroad rail 30 feet long varies in length about $\frac{7}{16}$ inches. Rails laid in the coldest weather should therefore be separated by this amount. If they are welded so that contraction does not occur, a stress of about 200 lbs. is caused by a change of one degree Fahr.

Contradiction. Any form of inconsistency; technically that in which one of two alternatives must be true and the other false.

Contragredient. Two sets of variables, when so related that a linear transformation of one set induces a reciprocal transformation in the other, *e.g.*, the Cartesian and the tangential coördinates of a locus.

Contralto. See ALTO.

Contrary Flexure. Beam so laid that a part curves in one direction and a part in another. Thus a beam supported at the middle and ends has its upper side concave near the ends and convex near the middle. The point of contrary flexure, or inflection point, is the place where the change occurs.

Contravallation. Defensive line constructed to prevent the besieged from making successful attacks by surprise against the besiegers. The besieging army was, in former times, located between this line and that of circumvallation, to prevent a succoring army from raising the siege. In modern warfare the importance of these lines has greatly diminished.

Contravariant. In higher analysis, such a derived form of one set of contragredients as retains its relation to its primitive when both the primitive and derived functions are transformed by reciprocal linear substitution.

Contre-Coup. Shock produced by transmitted violence, as when the base of the skull is fractured by a blow on the top of the head.

Contreras. Fourteen m. s. of the City of Mexico; scene of a battle between the U. S. forces under Gen. Scott and the Mexicans, Aug. 19 and 20, 1847. See CHURUBUSCO.

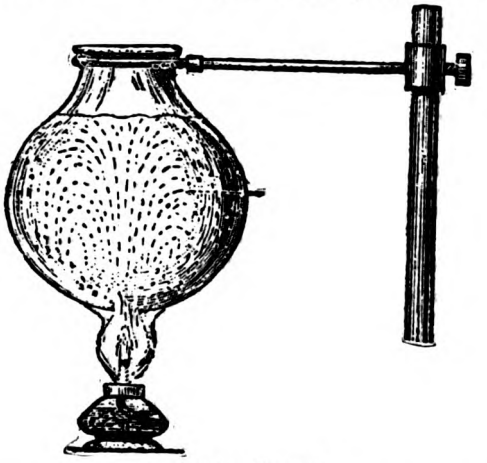
Contribution. In law, share to be borne by a joint obligor in discharging the common obligation; the principle underlying this duty is that when there is a common liability, equality of burden is equity; if the common liability arises from a willful tort, however, there is no duty of contribution.—In war, tax or imposition levied by the army commander on the inhabitants of a conquered town or territory.

Contusion. A wound produced by a blunt instrument which, without producing a break in the skin, lacerates the sub-cutaneous tissues. Perfect rest and bandaging, followed by massage, constitute the treatment.

Conus Arteriosus. Base of the truncus arteriosus; expansion next the heart-ventricle in the main aortic stem; in higher vertebrates, inclosed in the heart.

Convalescent. One who, having been sick or wounded, is regaining health, but as yet unfit for complete restoration to duty.

Convection. (1) Process of equalizing the temperature throughout the mass of a liquid or gas by currents caused by



Convection Currents.

differences of density. (2) Dissipation of an electric charge by successive electrification of different layers of air which come in contact with the charged body and are then repelled.

Convent. Establishment of monks or nuns. See MONASTERY.

Conventicle. Name of disparagement, applied by a prevailing church to the meetings of dissenters from it, legally used in England 1684.

Convention. (1) Treaty. (2) Political assembly, as in France 1792–96. (3) Agreement entered into by commanders of hostile armies, as for the surrender of an army, the evacuation of a fortified place and the like.

Convention-Parliament. One convened without the king's writs, *e.g.*, that which in 1660 restored Charles II., and that which in 1688 made the Prince of Orange king of England.

Converge. To tend toward a common point. Lines converge when they will if produced meet at a finite point.

Converging Series. One in which the sum of n. terms, as n. increases indefinitely, approaches as a limit a constant which is the true sum of the series.

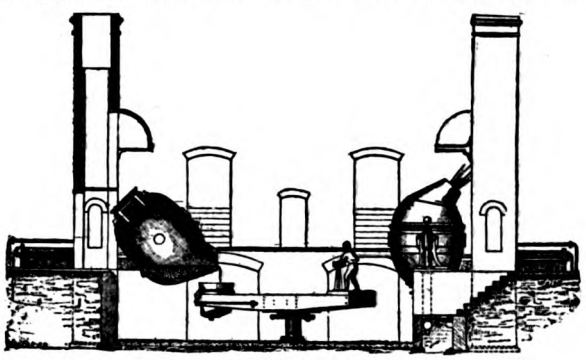
Conversion. In law, an unauthorized act which deprives another of his personal property permanently or for an indefinite time, such as the unlawful sale, destruction, withholding, or use of another's goods in hostility to his dominion as owner. The damages recoverable are generally the value of the property when converted; upon payment of the judgment for damages, the converter acquires title to the goods, which dates back to the time of conversion.—In religion, change of heart and life.

Conversion. Transposition of terms in logic; simple when subject and predicate can interchange places without affecting the quantity of the proposition; limited when the quantity is altered.

Converted Guns. During the transition period to the modern breech-loading sea-coast rifle, many of the 10″ Rodman guns were bored out and had a steel rifled tube inserted in them to convert them into 8″ rifles; their calibers are made less than before.

Converter. (1) Vessel in which the Bessemer process of making steel is conducted. It is a large vertical vessel of wrought iron, made in two parts, lined with infusible fire-brick, and capable of revolving about a horizontal axis. Its opening is at the top; in the bottom are a number of holes through which air is forced into the mass of molten iron within, the oxygen of the air effecting thus its decarbonization. When this stage has been reached, cast-iron, of the proper quantity and composition to convert the whole into steel of the required character, is run in and thoroughly mixed with the iron; the charge is then cast into ingots. See STEEL, BESSEMER.

(2) Apparatus for the distribution and conversion of electric



Converter.

energy; also called secondary generator and transformer. It acts on the same principle as the induction coil; but while the latter is usually employed to transform electric energy from currents of low potential and great quantity into currents of high potential and small quantity, the function of the converter is the reverse. This is accomplished by making the fine wire of the instrument the primary coil and the thick one the secondary; the details of construction, however, may be varied. The advantage of the system depends upon the fact that high potential currents can be conveyed to a distance over comparatively small conductors, and there converted into currents of a potential and quantity convenient for use.

Convex. Line or surface at any point on the same side with the rectilinear tangent at that point.

Conveyancing. That part of law which deals with the transfer of property, especially of real estate.

Convictions. Moral decisions or judgments, reached by the use of reason dealing with the facts of observation and experience, both in the external and in the internal world.

Convocation. In England, clerical representative synod of the archiepiscopal province of Canterbury or of York, having now little more than advisory power. In America, free conference of Episcopal clergy; also, an archdeaconry or division of a diocese.

Convolute. Method of vernation where the leaf is rolled up from one margin into a single coil, as in the Cherry.

Convolutions. Elevations upon the surface of the cerebrum, separated from each other by narrow fissures, which consist of gray nerve tissue, and in man are arranged in a highly complicated manner. In the lower animals they are lacking or simple; there is a close connection between their number and complexity and the intelligence.

Convolvulaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledones*, and series *Gamopetalæ*, comprising 36 genera and ab. 870 species, widely distributed through all parts of the world. Commonly called the Convolvulus family.

Convoy. Public ship of war accompanying merchant vessels for their protection. The convoy of a hostile ship of war renders all the protected property contraband of war. By treaty, the convoy of a neutral war ship relieves the conveyed vessels from visitation and search.

Convulsionists. Jansenist fanatics whose practices in the churchyard of St. Medard near Paris resembled the old accounts of demoniacal possession and called forth the interference of the law in 1733. Their excesses greatly injured Jansenism.

Convulsions. Involuntary movements of the muscles, contraction and relaxation usually alternating, with, as a rule, loss of sensibility. They may be a symptom of epilepsy, disease of the brain, irritation caused by the presence of undigested food or worms in the intestines, catalepsy, hysteria, uræmia, or a number of less important and rare conditions.

Conway, HUGH. See FARGUS, F. J.

Conway, MONCURE DANIEL, b. 1832 in Va. Minister at South Place, London, 1864–84 and from 1892; biographer of Carlyle 1881, Emerson 1882, Edmund Randolph 1888, Hawthorne 1890, and Thomas Paine 1892. His *Rejected Stone*, 1861, was a strong and effective tract against slavery. *Sacred Anthology*, 1874; *Idols and Ideals*, 1877; *Demonology*, 1879; *History of South Place Society*, 1894.

Conway, WILLIAM MARTIN. English traveler. *Climbing and Exploration in the Karakoram-Himalayas*, 1894.

Conway's Cabal. Band of conspirators whose object was to displace Washington from the command of the army, so called from Gen. Thomas (Count de) Conway, 1733–1800, who was in the American service 1777–78.

Conybeare, WILLIAM DANIEL, 1787–1857. Dean of Llandaff Cathedral, S. Wales. In geology especially known for his researches in the remains of oviparous quadrupeds, called by him Enaliosauria, and for the determination of immense vertebræ from the Lias near Bristol, giving them the name of Plesiosaurus.—His son, WILLIAM JOHN, 1815–1857, wrote, with Dean Howson, *Life and Epistles of St. Paul*, 1851.

Cook, DUTTON, 1832–1883. English novelist and critic.

Cook, ELIZA, 1818–1889. English poet, pensioned 1864.

Cook, JAMES, 1728–1779. English seaman, who circumnavigated the globe 1772–75, explored parts of Australasia and Bering Strait, and was killed at Hawaii. *Journal*, 1777.

Cook, JOSEPH, b. 1838. Monday lecturer in Boston from 1873. *Biology*, 1877; *Socialism*, 1880.

Cooke, GEORGE FREDERICK, 1756–1812. English actor, long a star in London, Dublin, Manchester, etc., and in the U. S. from 1810.

Cooke, GEORGE WILLIS, b. 1848. American lecturer, biographer of Emerson 1881 and George Eliot 1883. *Guide Book to Browning*, 1891.

Cooke, JAY, b. 1821. American financier; agent of the U. S. for war loans 1862–65, and later of the Northern Pacific R. R. His failure in 1873 precipitated a panic.

Cooke, JOHN ESTEN, 1830–1886. Va. novelist; biographer of Gens. J. J. Jackson, 1863–76, and R. E. Lee, 1871. *Virginia Comedians*, 1854; *Mohun*, 1868; *Virginia, a History*, 1883.

Cooke, JOSIAH PARSONS, LL.D., 1827–1894. Prof. chemistry and mineralogy Harvard from 1851. *Chemical Physics*, 1860; *Religion and Chemistry*, 1864. He determined the atomic weight of antimony.

Cooke, MRS. ROSE (TERRY), 1827–1892. New England poet and story-writer, m. 1873. *Poems*, 1860–88; *Happy Dodd*, 1879; *Somebody's Neighbors*, 1881.

Cooke, SIR WILLIAM FOTHERGILL, 1806–1879. English electrician, partner of Wheatstone from 1837; knighted 1869.

Cookeite. Micaceous mineral, associated with the rubellite and tourmaline of Maine. It contains lithium.

Cookery. Mural paintings prove that this art was important in Egypt, but it was the Persians who introduced culinary refinement into Greece. Plato, Xenophon, and Socrates taught the Greeks the delights of the table, with wit and good cheer in combination. The cook rose in social importance till the Seven Sages were matched by the seven cooks: Chariades of Athens, Ægis of Rhodes, perfect at broiling fish, Nereus of Chio, whose eel-soup was worthy of the gods, Lamprias, adept at black broth, Aphthonete, inventor of sausage, Euthydemus, dresser of lentils, and Aristion, inexhaustible of resource in the matter of stews.

The Athenian cooks had marvelous skill, and by means of

sauces, spices and flavorings they could disguise their dishes so as to deceive the ablest connoisseur. The Sicilians were most celebrated; Mithæus of Sicily was banished by the Lacedemonians, lest he should corrupt them with his culinary temptations. At Rome, as long as frugality lasted, the common slave was the cook, but after the Eastern conquests luxury increased till a good cook cost as much as a triumph. Anthony would reward his chef with an estate, sometimes the property of one of the guests, but a spoiled dish earned him an unmerciful beating, the guests assisting. Oysters were brought from England and sturgeon from Russia. The Roman cooks were skillful in giving fish the shape and flavor of others out of season. Strange flavorings were introduced, as rue and asafetida. Incredible sums were lavished on the table. Apicius spent $4,000,000, and committed suicide when he had only $400,000 left. Pheasants' and thrushes' brains and nightingales' tongues were rare delicacies. Pollio chopped up two slaves a day to improve the flavor of his carp. Pyttilus fitted an asbestos sheath to his tongue to enable him to swallow hotter sauces and condiments. Vitellius the Imperial Glutton had 2,000 fishes and 7,000 birds served at one feast, and his Shield of Minerva was a dish whose ingredients cost $72,000. During the 8 months of his reign he spent $36,000,000 on the table. Heliogabalus among other follies served to his guests peas mashed with grains of gold, beans fricasseed with morsels of amber, and rice mixed with pearls. Domitian convened the Senate to discuss the merits of a new sauce.

Mediæval cookery was solid rather than refined, though a remarkably fine cuisine was generally found in the abbeys. At the great feasts, however, soups and fruits, meats and sweets, were indiscriminately mixed. Much time and skill was devoted to the ornamental dishes, huge piles of paste full of surprises, sometimes a flock of birds, sometimes even a dwarf. These subtleties were sometimes towers and castles or counterfeit birds and beasts with "scriptures" attached conveying words of exhortation or welcome. The cooks took themselves very seriously, witness Vatel, the Prince of Condé's chef, who at Chantilly, at the great entertainment to Louis XIV., killed himself because the fish came late. Modern cookery began with the *petits soupers* of the Regent D'Orleans. Louis XV. followed in the steps of the Regency, and his mistresses and courtiers vied with the cooks in inventing new dishes. The cooks of Languedoc were the best and it was safer to elope with a ward in Chancery than to tamper with the allegiance of a *maître d'hôtel*. In Holy Week the royal dinner consisted of vegetables in the form of every fish in the sea. Cookery languished again for a time under the blighting influence of Louis XVI.'s robust appetite and the bourgeois indifference of the Revolution, but Napoleon encouraged his ministers to make an art of dining, in which Talleyrand was supreme. The French have never since lost their pre-eminence in the excellence and delicacy of their dishes and in the wealth and multiplicity of ingenious resource. Delicacy and disguise are the dominant notes of modern French cookery, recalling the profound aphorism of an ancient Greek: "The most delicate meat is that which is least meat; the most exquisite fish is that which is least fish."

Cooley, THOMAS MCINTYRE, LL.D., b. 1824. Prof. of Law Univ. Mich. 1859; Justice of Mich. Sup. Ct. 1864; Chief-Justice 1867; Interstate Commerce Commissioner 1887. *Constitutional Limitations*, 1868; *Torts*, 1879; *Constitutional Law*, 1880.

Coolidge, THOMAS JEFFERSON, b. 1831. U. S. Minister to France 1892–93.

Coolies. East Indian and Chinese laborers who emigrate either independently or under contract with foreign employers. The former abuses of the contract system which amounted to practical slavery have been reformed by Chinese treaties and Indian government inspection. The Indian Emigration Act of 1883 only permits contract-emigration to Mauritius, Jamaica, British and Dutch Guiana, Trinidad, St. Lucia, Grenada, St. Vincent, Natal, St. Kitts, Fiji, Martinique, Guadeloupe, and St. Croix. These colonies contain ab. 450,000 Indian coolies. The Chinese have been restricted recently in America and Australia by Exclusion Acts.

Coon. See RACCOON.

Cooper, ANTHONY ASHLEY. See SHAFTESBURY.

Cooper, SIR ASTLEY PASTON, LL.D., D.C.L., F.R.S., 1768–1841. English surgeon, made Baronet 1820. *Hernia*, 1804–7; *Dislocations and Fractures*, 1822; *Diseases of the Breast*, 1829–40.

Cooper, JAMES FENIMORE, 1789–1851. Leading American novelist of the old school. His reputation was made by *The Spy*, 1821, and increased by his Leatherstocking series and sea tales. *Pioneers*, 1823; *Pilot*, 1823; *Last of the Mohicans*, 1826; *Prairie*, 1827; *Red Rover*, 1828. His later romances, especially those based on his European observations 1826–32, are of less value. He wrote a *History of the Navy*, 1839, in which he had served 1808–11.—His daughter, SUSAN FENIMORE, 1813–1895, pub. *Rural Hours*, 1850, and *Rhyme and Reason of Country Life*, 1854.

J. Fenimore Cooper.

Cooper, PETER, 1791–1883. American ironmaster and philanthropist; founder of the Cooper Union in N.Y. City, 1854–59, containing free science and art schools for both sexes, with an attendance of over 3,000.

Cooper, THEODORE, b. 1838. Civil engineer; designer of many important bridges. *American Railroad Bridges*, 1890.

Cooper, THOMAS, b. 1805. English poet, journalist, and novelist, once a Chartist lecturer. His *Purgatory of Suicides* and *Wise Saws* were written in prison 1842–44. *Alderman Ralph*, 1853; *Autobiography*, 1872.

Cooper, THOMAS APTHORPE, 1776–1849. Anglo-American actor.

Cooperage. Art of making casks and barrels, known to the ancients. Modern machinery is supplanting hand-work. Cooperage is also an illegal traffic in spirits and tobacco supplied to the fishing-smacks in the North Sea. The six fishing powers prohibited it at The Hague Convention 1887.

Coöperation IN CREDIT. Union of a group of persons, each contributing a small amount of capital, which when combined may be loaned to one of their own number on interest which is divided among all. Such contributions and loans are made each month by all the group, and in this form such bodies are called building societies or coöperative banks. Or they may consist of persons joining together and making themselves liable for the authorized purchases by one of their number; in this form, more common in Germany, as the former is in the U. S., they are called raw-material societies, or coöperative loan societies.

Coöperation IN DISTRIBUTION. Union of persons to establish a store at which they, and perhaps others, buy their supplies. The net income from the business is divided among the coöperators, partly as interest on their capital invested, and partly as profits. The system has reached large proportions in England, and has spread to Germany and other countries.

Coöperation IN PRODUCTION. Union of a number of persons to establish a factory or similar productive establishment in which they are themselves the laborers, and have control of the business. Therefore not only the wages of labor, but the profits of management, and, in as far as the coöperators have provided the capital, interest, all go to them.

Coöperative Associations. Organizations in which the members combine to carry on some economic function in such a way as to retain the control of the business and to save for themselves interest or profits, or both, as well as wages where the coöperators are workmen.

Coördinates. Measures which taken together determine position, and, through their relations formulated in equations, express the law of successive positions which form loci.

Coördinates, CELESTIAL. In fixing the position of a star as seen projected on the celestial sphere, either of three systems of spherical coordinates may be employed, viz., latitude and longitude, the fundamental plane being the ecliptic; right ascension and declination, in which the fundamental plane is the equator; or altitude and azimuth, referred to the horizon as fundamental plane. For fuller definitions see under those heads.

Coördinates OF POSITION IN SPACE. The system here used is generally that of three planes intersecting at right angles, called axial planes. The discussions follow closely those of Cartesian planar coordinates, though other systems, especially polar, are often used.

Coördinates, POLAR. System in which the fixed data are an initial straight line and a fixed point upon it called the pole; the measurements are distance of the point from the pole, called radius vector, and the angle of this with the initial line. They are usually indicated by the Greek letters ρ and δ.

Coördinates, POLAR, IN SPACE. These have for fixed data an initial plane, an initial line therein, and a fixed point on the line; the variable elements are the angles and a distance.

Coördinates, SPHERICAL. Used to determine position on the surface of a sphere. The terrestrial are Latitude and Longitude.

Coördinates, SYSTEM OF. Method of determining position by any fixed data by means of definite measurements. Systems differ as the positions are determined on a plane surface, a curved surface, or in space, and also according to the character and relations of the fixed data.

Coördinates, TANGENTIAL. System by which a locus is determined through a group of consecutive rectilinear tangents.

Coördinates, TRILINEAR. Planar system in which position is determined by means of the ratios of the distances of the point from the sides of the triangle of reference. This triangle is conventionally A B C, its sides a, b, c, and the coördinates α,β,γ, being perpendicular to a, b and c respectively. If Δ = the area of the triangle of reference, there comes the general equation of condition, $a\alpha+b\beta+c\gamma=2\Delta$.

Coorg. Province of India s.w. of Mysore, near the Malabar Coast; area 1,583 sq. m.; pop., 1891, 178,302. It is an elevated forest region with heavy rainfall. Coffee plantations occupy 62,167 acres, and gold and iron are found. The natives are of fine physique.

Coote, SIR EYRE, 1726–1783. Irish officer in India, knighted 1771. He took Pondicherry 1761, became Commander-in-Chief 1779, and overthrew Hyder Ali 1781.

Copaiba. *Copaifera officinalis.* Tall tree of the natural family *Leguminosæ*, native of tropical America, yielding Balsam of Copaiba. A similar substance is obtained from other species of the genus. This oleoresin increases the secretion of urine, and is largely used in the treatment of gonorrhœa.

Copaifera officinalis.

Copais. Lake in Bœotia, formed mainly by the river Cephisus, and discharging its waters into the sea by subterranean channels.

Copal. Species of resin exuded by the *Vateria Indica* in e. India, and by the species of *Hymenea* in Brazil. It is also obtained from w. Africa under the name of Gum Animé. It is largely used in the manufacture of varnishes.

Copalite. Fossil resin found in clay near London.

Copan. Indian village in s.w. Honduras; site of an ancient city, of which fine ruins remain.

Coparcenary. In English law joint succession to an estate. Coparceners are such as have equal shares in the inheritance of an ancestor.

Co-partnership. See PARTNERSHIP.

Cope. Long mantle worn by priests and dignitaries of R.C. Ch. in functions other than the mass. Armenians wear it during mass. In the Greek Ch. its use is confined to archimandrites and bishops.

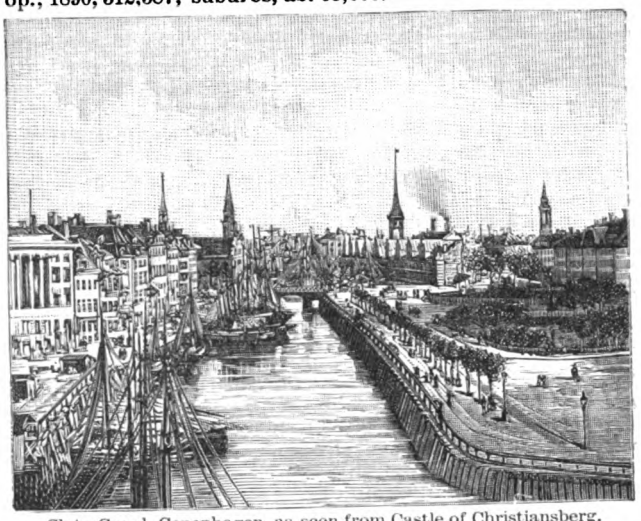
Cope, EDWARD DRINKER, b. 1840. Paleontologist to U. S. Geological Survey of the Territories; prof. of Geology in Univ. Pa. from 1889.

Cope, SIR JOHN, 1707–1760. English general, defeated by the Pretender at Prestonpans Sept. 21, 1745.

Copec, or **Kopeck.** Russian copper coin, $\frac{1}{100}$th of a rubles

Copelatæ (PERENNICHORDATA). Small, free-swimming Ascidians, of elongated form, with a tail, but no cloaca nor atrium. The tail has a notochord, above which is a segmented nerve-cord with ganglia. There are only two branchial slits. *Appendicularia* is an example.

Copenhagen. Capital and commercial center of Denmark; on e. coast of Seeland, near s. end of the Sound. It has an excellent harbor, is built mainly on low ground, and is irregularly planned. It was a fishing and trading post ab. 800, was fortified 1157, became the capital 1443, was besieged by Charles X. 1658, and bombarded by the British 1700, 1801, and 1807. Pop., 1890, 312,387; suburbs, ab. 63,000.



Slots Canal, Copenhagen, as seen from Castle of Christiansberg.

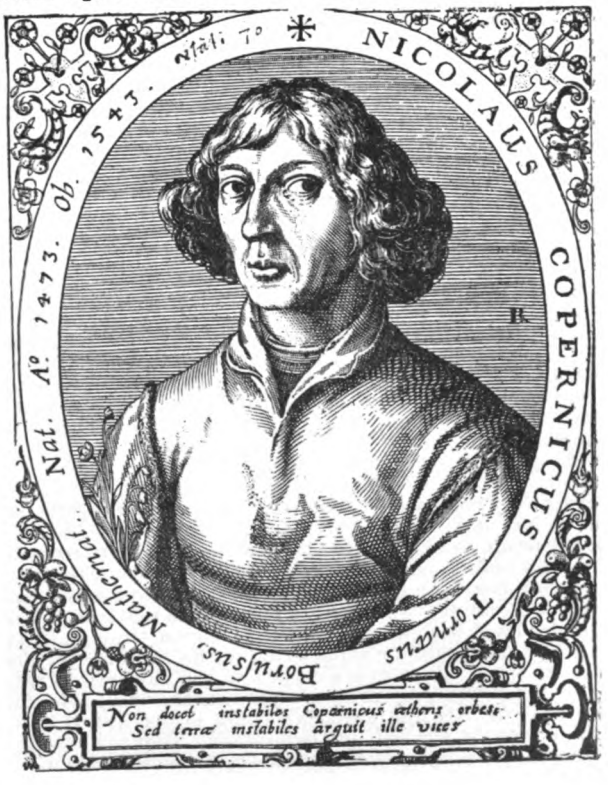
Copenhagen. Game played by boys and girls who stand in a circle, holding a rope, of which the ends are tied together. The player who is "it" stands within the ring and endeavors to slap the hands of the others, using only one hand at a time. Each player must hold the rope with one hand, and may try to escape being slapped by changing hands rapidly. If one's hand is slapped or he lets go the rope, he must change places with the one in the ring.

Copenhagen Museum. Of Northern Antiquities; it holds the first rank for objects of the Stone and Bronze Ages, for which periods Scandinavia offers the most remarkable and numerous illustrations. The Danish archæologist Worsaae has done most for perfecting its collections.

Copepoda. *Entomostraca*, with a shell, not formed by the folding back or down of the skin, and with biramous swimming appendages on the thorax, but none on the abdomen; *e.g.*, *Cyclops*. Many Copepods are morphologically degraded through parasitism, such as *Actheres* and various Fish-lice. There are two sub-orders, *Eucopepoda* and *Branchiura*.

Copernican System. Now universally held as to the planets; it regards the sun as the central body, about which the planets, including the earth, revolve.

Copernicus, NICOLAS, 1473–1543. Astronomer; canon of Frauenburg, Prussia, from 1499. His scientific investigations



culminated in his theory regarding the mechanism of the solar system. His book, *De Orbium Celestium Revolutionibus*, completed 1530, was pub. just before his death, and despite violent opposition overturned previously received ideas of astronomy.

Coping. Projecting flat stone on top of a wall, protecting it from the weather, and also serving as an ornament; covering course of a masonry scarp or counterscarp wall.

Copland, JAMES, M.D., 1791–1870. Scottish medical writer. *Dict. Medicine*, 3 v., 1832.

Copley, JOHN SINGLETON, 1737–1815. American portrait painter, active in London after 1775. His pictures are in the National Gallery and in Boston. *Death of Chatham*, 1780.

Coppée, FRANCOIS EDOUARD JOACHIM, b.1843. French poet and dramatist, Academician 1884. *Le Passant*, 1869; *Mme. de Maintenon*, 1881.

Coppée, HENRY, LL.D., 1821–1895. U. S. army officer 1845–55; prof. West Point, Univ. Pa., and Lehigh Univ.; pres. Lehigh Univ. 1866–75. *Logic*, 1857; *Rhetoric*, 1859; *Lives of Gens. Grant*, 1866, and *Thomas*, 1893; *English Literature*, 1872; *Conquest of Spain*, 1881.

Copper. Cu. At. wt. 63.09. One of the few metals known to the ancients. From the mines of Cyprus it got its Latin name, *cuprum*, and from this the English name is derived. Copper is present in a large number of minerals, ten of which are sufficiently rich and abundant to be valuable as ores; viz., native copper, chalcocite, bornite, chalcopyrite, tetrahedrite, cuprite, melaconite, chrysocolla, malachite and azurite. Of these the most important are native copper and chalcopyrite, the latter being of world-wide distribution. Copper ores are not restricted to any one geological formation nor to any one mode of occurrence. Some of the more productive districts have been in s.w. England, Spain, Chili, and, in the U. S., Mich., Montana, and Arizona. Copper is soluble in the common acids. It forms two classes of salts: cuprous, in which it is univalent, and cupric, in which it is bivalent.

Copper, METALLURGY OF. Native Copper is found in Cornwall, Brazil, and Siberia, and in enormous deposits on the s. shore of Lake Superior, where masses have been found of over 400 tons. This ore frequently carries native silver. Red Copper Ore is a sub-oxide of copper of a deep red color, found in Cornwall and Chili. Copper Glance is a shining black mineral, chemically copper sulphide. Copper Pyrites is a brass yellow mineral, sometimes mistaken for gold. It contains copper, iron, and sulphur, and is found in large deposits in Cornwall, Germany, China, Japan and the U. S. The carbonates of copper, Azurite, and Malachite, are important ores, found in large quantities in s. Australia and Chili.

Copper has been known from the earliest times, but the first metal was probably either native metal or else prepared from the oxide or carbonate ores by heating them with carbon. At present all kinds of ores are treated by many different methods, which may be generally classed under (1) furnace smelting and (2) aqueous treatment. The first is varied according to whether the ores are combinations with sulphur or oxide ores. In treating sulphide ores, the principle is used that copper has greater affinity for sulphur and less for oxygen than most of the other metals it may be associated with. The ore is therefore first heated in a furnace with free access of air, which results in oxidizing some of the foreign metals, such as iron, and driving off some of the sulphur. After this roasting, the ore is melted down in another furnace, when the copper will be found concentrated as copper sulphide with some iron sulphide, a product termed matte, while much iron and foreign matter unite to a slag which floats on top of the matte and can be easily separated from it. A repetition of the roasting and melting gradually removes the impurities and drives off sulphur, until a product containing 90 per cent of copper, called black copper, is obtained. This is roasted until all the sulphur is driven off, which leaves dry copper, containing much oxygen, which is then refined by stirring with a pole of green wood, an operation called poling. These operations are varied in many different ways, one of the principal changes brought into modern practice being the first smelting down of the ore in water-jacketed cupola furnaces instead of on the hearth of reverberatory furnaces. Sulphide ores are frequently first utilized for making sulphuric acid, and the residues then smelted down as above. In Sweden the ore is first roasted in open piles before being put into the furnaces. A recent improvement has been the treatment of the matte in vessels similar to Bessemer converters. The molten matte is put into a cylinder lined with fire-brick, and air blown through it, thus oxidizing out its sulphur and leaving in the converter either a richer matte, or even crude copper, if the blowing is kept up long enough. This process is carried on extensively in Montana. Oxide ores (oxides and carbonates) are either mixed in with sulphide ores or worked by themselves. They are easily reduced alone by mixing with charcoal and smelting down.

Wet processes are applied only to poor ores, whose foreign material is not easily dissolved. The principle employed is to get the copper into the form of a salt in solution, and then separate it from the solution by precipitation with iron or by electric deposition. If the ore is a sulphide, a careful roasting at a moderate heat will produce copper sulphate, which can be washed out. If the ore is an oxide, dilute acids must be used to dissolve out the copper. The solutions thus obtained are put into tanks with scrap-iron, which displaces the copper in the solution, precipitating it as a metallic powder, which is washed and melted down. Using electricity, a current is passed through the solution, using an iron anode, which dissolves as the copper is deposited. These processes are modified in numerous ways.

The crude copper obtained by smelting is frequently refined by electricity. The impure metal is cast into plates, and hung in a solution of copper sulphate, opposite to a thin sheet of pure copper. The current deposits pure copper on the thin sheets, and the heavy plates are correspondingly dissolved; the impurities, however, remaining mostly undissolved and falling to the bottom of the tank. Over one-half the pure copper made is thus treated.

Copper is a soft, malleable metal, color a peculiar brownish-red. Sp. gr. 8.95, third metal in malleability, sixth in ductility, second in conductivity for heat and electricity. Specific heat 0.09, fusing point 1,055° C. (1,900 F.), latent heat of fusion 43 calories. The tensile strength is 25,000 lbs. per sq. inch in ingot, 30,000 lbs. in sheet, and up to 60,000 lbs. in wire.

Pure copper is used principally for electrical conductors, in all electrical apparatus, and in batteries; also for cooking utensils, sugar pans, and as sheathing-metal for ships. Until recently, all small-value coins were made of copper. The alloys of copper and other metals are numerous and important. Very small quantities of almost any metal will spoil the good qualities of pure copper without giving any advantages; but larger quantities of the same metals form useful alloys. Gold is usually hardened by adding to it one-ninth part of copper, which gives it a reddish tinge. This is the standard alloy for U. S. gold coins. Silver is alloyed with copper in the ratio 9 to 1 to form coin silver and usual solid silver ware. Bronze, as made by the ancients, was copper with a little tin; an antique weapon from the Bronze Age contained 6.8 per cent. Modern bronzes are essentially alloys of copper and tin, with sometimes a small amount of another metal. Gun-bronze contains 10 per cent tin, and has a tensile strength of 30,000 lbs. Bell-bronze has 20 to 22 per cent, speculum metal for telescopes 31 per cent of tin. Coin-bronze is 95 copper, with 5 parts of tin and zinc together, usually 3 of tin to 2 of zinc. Ormolu metal, used for small works of art, has a beautiful golden color, and contains 17 per cent tin and 25 zinc. Anti-friction bronze carries 2 to 14 per cent of zinc, and 10 to 20 of tin. Chinese bronzes contain about 5 per cent tin, 10 to 20 lead, 2 to 6 zinc, and up to 2 of iron. Phosphor bronze is any bronze into which phosphorus has been stirred to deoxidize it. The most usual composition is tin 5 to 10 per cent, phosphorus 0.05 to 0.75. This alloy is very tough, with a tensile strength in castings of 40,000 lbs., in sheet up to 100,000 lbs. Manganese bronze is made by combining ferromanganese with various strong bronzes, containing therefore up to 1 per cent of iron and up to 15 of manganese. It is a very strong metal, used particularly for steamship propellers. Statuary bronze contains 10 to 18 per cent of zinc and 2 to 4 of tin. German silver contains 20 to 30 per cent zinc, 10 to 20 nickel, the rest being copper. Silicon bronze contains up to 5 per cent of silicon; being exceedingly strong in wire, and, having good electric conductivity, it is used for telephone lines. Aluminium bronze contains 3, 5 or 10 per cent of aluminium. The tensile strength of this bronze in castings reaches 90,000 lbs. Brass is an alloy of zinc and copper, known from the earliest times, formerly made by heating metallic copper with zinc ores, now by melting copper and adding to it metallic zinc. The color varies with the proportion of zinc, which never exceeds 50 per cent, as follows:

10 per cent of zinc—Yellowish-red,
15 " " " " Reddish-yellow,
25 " " " " Pale yellow,
35 " " " " Full yellow,
50 " " " " Whitish-yellow.

The amount of copper produced in the world in 1893 was 237,000 long tons, of which the U. S. furnished nearly two-thirds. Refined copper sold at the close of 1894 at 9 cts. per lb.

Copperas. See FERROUS SULPHATE.

Copper Ferrocyanide. $Cu_2Fe(CN)_6$. Reddish-brown precipitate, formed when potassium ferrocyanide is added to a copper solution. This is an exceedingly delicate test for copper.

Copper Fire-Box. In earlier American and in foreign locomotive practice the sheets exposed to the fire in the fire-box have been made of sheet-copper, ab. ½ inch thick. The advantages were its high conductivity for heat and the ease with which it could be shaped and would endure expansion

strains. The objections are its cost, and its softness, which will not resist abrasion from cinders nor withstand abuse from firing tools.

Copper Glance. See CHALCOCITE.

Copper-Head. *Trigonocephalus contortix.* Venomous serpent allied to the Rattlesnake, from 2 to 3 ft. in length, of a light copper color with darker transverse bars. Found in the e. U. S., but most numerous in the Southern States. Lives in dark, shady places, or in high meadow-grass.—Also a name given in the North to a person who sympathized with the South in the American Civil War. See ANCISTRODON.

Coppermine River. In Northwest Territory, Canada, flowing into Coronation Bay, Arctic Ocean.

Copper Nickel (NICCOLITE). NiAs or (Ni_3As_3). Mineral compound of nickel and arsenic, resembling copper in color.

Copper Pyrites. See CHALCOPYRITE.

Copper River. In Alaska, flowing s. into the Pacific near lat. 61° N., long. 145° W.

Coprodæum. Part of the cloaca which is innermost and receives the fæces first.

Coprolites. Petrified excrements, chiefly of Saurians and Fishes, found in Palæozoic and many later strata; often containing fragments of scales, shells, and other undigested matter.

Coptic Church. In Egypt, remnant of the ancient Catholic Ch., now Monophysite and esteemed heretical.

Coptic Language and Literature. Coptic was the language of Egypt under the Ptolemies, being the development of ancient Egyptian under Semitic influence, with a large admixture of Greek words and forms. It was still in use in the 9th century notwithstanding the Arab conquests and persecutions, and though extinct in Middle and Lower Egypt in the 12th it survived in Upper Egypt until the 17th century. The religious services of the Copts are still conducted in this language, but with Arab interpreters. The ancient demotic alphabet was supplanted by the Greek uncial when Egypt was converted to Christianity, and since the beginning of the 5th century all religious works have been written in this character. There are three dialects, Sahidic, Memphitic, and Bashmuric; the latter, perhaps, most closely resembles the hieroglyphics. The literature consists entirely of religious works, including translations of the Bible.

Copts. Christian descendants of the ancient Egyptians, numbering 500,000 or less.

Copulæ. See BASIBRANCHIALS.

Copulation of Sexual Cells. Properly used only in the case of the so-called hermaphrodite Ciliates, in which nuclear elements are mutually interchanged during copulation, and the cells separate after the act. See CONJUGATION.

Copyhold. Form of tenure of land which in England generally superseded the pure tenure at will of serfdom. Its name arose from its conditions being recorded on the rolls of the manor court, and thence copied. It was the basis of the landholding system of England ab. 1200–1600, and even later.

Copying. See ENGRAVING, PHOTOGRAPHY, LITHOGRAPHY.

Copyright. Right of the owner of a literary publication to prevent all others from copying it: it rests upon statute. In the U. S., the term for which a copyright may be obtained is 28 years, with a right of renewal for 14 years in most cases. International copyright, though long existent between other countries, was not granted by U. S. till 1891, and then imperfectly.

Coquelin, BENOIT CONSTANT, b. 1841. Comedian, connected with the Théâtre Français 1863–86. He appeared in London 1879 and 1892, and in America 1888.—His brother, ERNEST ALEXANDRE HONORE, has been a member of the same company since 1876.

Coquerel, ATHANASE LAURENT CHARLES, 1795–1868. Protestant pastor at Amsterdam 1818–30, and in Paris; noted for eloquence and liberal views. *Modern Orthodoxy*, 1842; *Christianity*, tr. 1847.—His son, ATHANASE JOSUE LAURENT, d. 1875, was a leader of the same school.

Coquina. Rock composed of cemented shells; found chiefly in Florida.

Coracle. Small canoe made by stretching skins over a wooden framework, used by the Britons at Cæsar's invasion. It is still to be seen in the west of England and w. coast of Ireland, and was in use in Scotland till the close of the 18th century.

Coracoid. Posterior ventral element of the pectoral arch or "shoulder girdle." In higher Mammals it is only a process of the scapula, but in other Vertebrates it articulates as a separate bone with the sternum.

Coracomorphæ. Order of Birds, nearly equivalent to the Passeres, including Finches, Wagtails, Larks, Thrushes, Honey-eaters (*Meliphagidæ*), Swallows, Fly-catchers, Shrikes, Wrens, Tomtits, Starlings, Birds of Paradise, and Crows.

Coral. The Madrepore division includes the common bleached corals of shops and museums, including a great variety of forms, spherical, plate-like, branched, crenulated, and others. See ZOANTHARIA and MADREPORARIA.

Coral-Berry. *Symphoricarpos orbiculatus.* N. American shrub of the Honeysuckle family; called also Indian Currant.

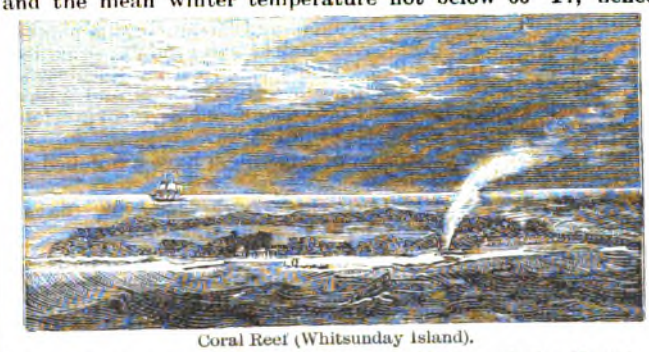
Corallin. Probably the rosaniline salt of rosolic acid; prepared by the action of ammonia upon aurine; red-brown powder, soluble in alkali, insoluble in water; formerly used in dyeing wool red; called also Pæonin.

Corallines (CORALLINACEÆ). Order of *Florideæ* or red Algæ, comprising most of the species which form a calcareous incrustation on their surfaces, causing resemblance to corals; mainly of tropical distribution; called also Millipores.

Coralline Zone. See BATHYMETRIC DISTRIBUTION.

Corallite. Part of the hard coral secreted by an individual polyp.

Coral Reefs, or CORAL ISLANDS. Narrow islands composed of coral rock, that lie parallel with the shore of continents or islands. When small and close to shore the reef is a fringing reef; when further out and rising out of deep water, it is a barrier-reef. Encircling reefs surround islands; when the central island is sunk below the water's surface, it is an atoll. Corals flourish only where the water is less than 30 fathoms and the mean winter temperature not below 66° F.; hence



Coral Reef (Whitsunday Island).

these islands are usual only within 1,800 m. of the Equator. Barrier reefs can be accounted for only by supposing the ocean bottom to have sunk as the corals built upward. The corals die when the surface is reached, and growth continues only on the sides of the reef. Then the breakers grind up the coral and pile the sand into ridges; aided by the wind, these may attain considerable heights. The sand becomes gradually cemented together to form coral rock.

Coral-Root. Orchids of the genus *Corallorhiza*, natives of the n. hemisphere.

Coral-Tree. *Erythrina Corallodendron.* Low tree of the natural family *Leguminosæ*, native of the West Indies. Its large seeds are hard and red, and are made into necklaces.

Cor Anglais. See ENGLISH HORN.

Coray, DIAMANT, 1748–1833. Greek, resident in France, ed. of several classics and commentator on Homer.

Corbel. A stone projecting from a wall to support another structure, as a cornice, balcony, chimney-piece, arch or vault. Often used on the piers of wooden bridges.

Corbel-Table. In architecture, a member formed by a series of corbels supporting a horizontal ledge, as a sill-course platform or cornice.

Corbet, RICHARD, D.D., 1582–1635. English poet; Bp. of Oxford 1629, and Norwich 1632.

Corbiesdale. In n. Scotland; scene of defeat of Montrose by the Covenanters, April 27, 1650.

Corbie Steps, or **Crow Steps.** Series of horizontal projections at the side of a gable, first employed in German Gothic, and especially frequent in Dutch and Flemish work.

Corbould, EDWARD HENRY, b. 1815. English painter and illustrator.

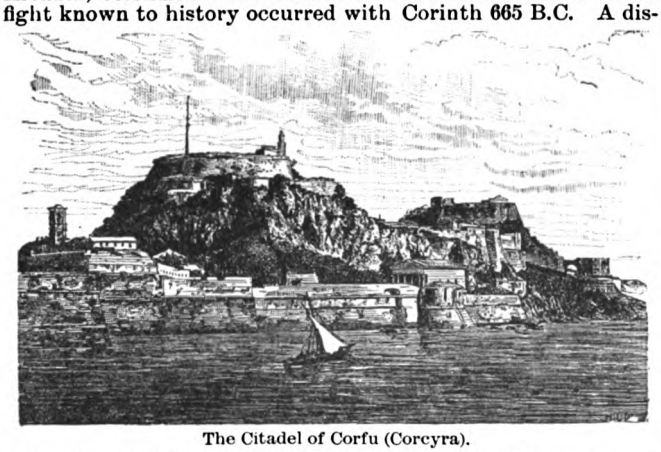
Corbulæ. Basket-like receptacles, inclosing groups of gonangia in certain plumularian Hydroids.

Corbulo, CNÆUS DOMITIUS, d. 66. Roman general, victorious over the Parthians.

Corcoran Gallery of Art. In Washington D.C.; founded 1857 by Wm. Wilson Corcoran (1798–1888); opened to the public 1874. It contains a fine series of Barye bronzes, a good collection of casts from antique and Renaissance art, and over 200 paintings, including Gérome's *Cæsar Dead*, and Church's *Niagara Falls.*

Corcyra, now **Corfu.** Largest of the Ionian Islands; w. of

Albania; colonized from Corinth ab. 734 B.C. The first sea-fight known to history occurred with Corinth 665 B.C. A dis-



The Citadel of Corfu (Corcyra).

pute with Corinth about Epidamus led to the Peloponnesian war. C. came into the hands of the Venetians 1386; formed part of the Ionian Republic 1815–64, when it was annexed to Greece. Area 227 sq. m.; pop., 1889, 84,492.

Cordaites. Genus of Devonian and Carboniferous plants, having long strap-shaped leaves and bearing the flower called Antholithus, the fruit called Cardiocarpon, with a Sternbergia for its pith. In affinity it approached the Conifers, and is now held to include such forms as *Dadoxylon* and *Araucarioxylon*, which were formerly considered coniferous.

Cordate. Leaves or other organs which have a notched or heart-shaped base.

Corday d'Armans, MARIE CHARLOTTE, 1768–1793. Slayer of the terrorist Marat, July 13, 1793; guillotined July 17.

Cordeliers. Red Republican club in Paris, 1790–95, led by Danton, Marat, and Desmoulins; named from their place of meeting, an old convent of the Cordeliers, a Franciscan order. See JACOBINISM.—Also Franciscan friars clothed with a cloak, chaperon, and small cowl, all of thick gray cloth and with a three-knotted cord girdle from which they take the name.

Cord Grass. Large, coarse marsh grasses of the genus *Spartina*, natives of N. America.

Cordier, PIERRE LOUIS ANTOINE, 1777–1861. French geologist and mining engineer.

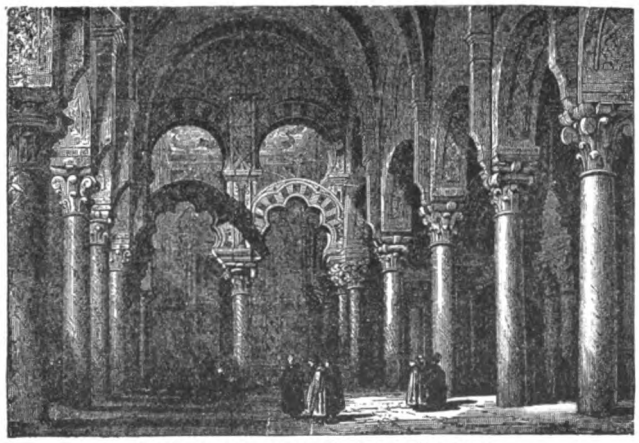
Cordierite. See IOLITE.

Cordilleras. Ranges of the Andes, in S. and Central America.

Cordon. Line of sentinels inclosing a given area to prevent the unauthorized passage of persons. Daily and nightly cordons are established in siege operations to give timely warning of the approach of the enemy to the supports of the working parties.

Cordoba. Province of Argentina, area 54,000 sq. m., pop. 380,000. It is well watered and fertile, affording good pasturage for cattle and producing much grain. The capital of the same name, pop. 66,000, founded 1573, on the Rio Primero, has a fine old cathedral, university, and large beef, hide, and wool trade.

Cordova. City of s. Spain on the Guadalquivir; founded by the Romans 152 B.C. It became the capital of an Arab



Hall of Prayer in the Mosque at Cordova.

kingdom 756, was taken and nearly destroyed by Ferdinand III. of Castile 1236. It was noted for its mosques, palaces, and university, and held by the French 1808–13; birthplace of Seneca, Lucan, and Averroes. Its leather was highly prized. Pop., 1887, 55,614.

Cordova, FRANCISCO HERNANDEZ DE, ab. 1475–1526. Spaniard who discovered the e. coast of Yucatan 1517 and founded towns in Nicaragua.

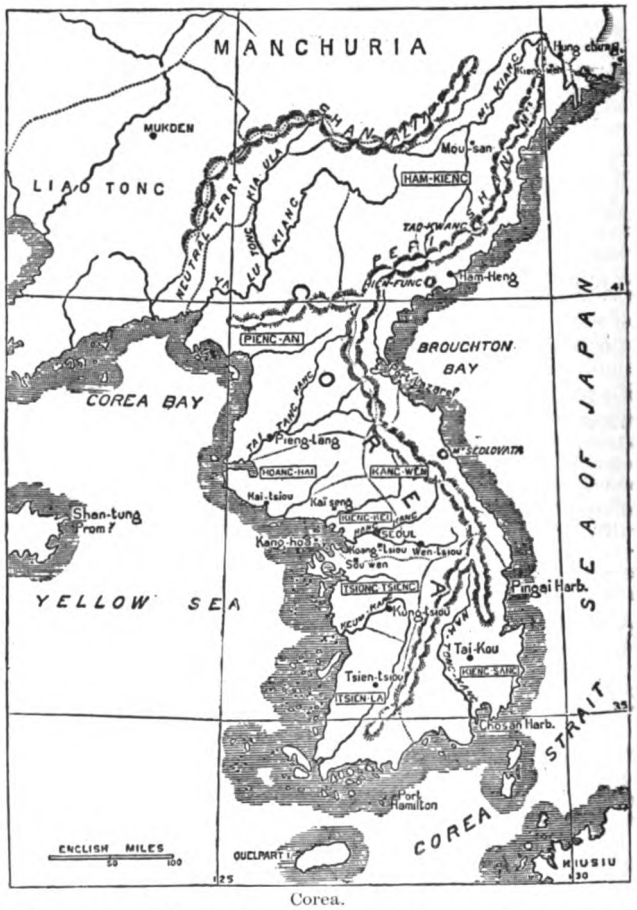
Cordova y Figueroa, PEDRO DE, 1692–ab. 1775. Chilian historian.

Corduroy Road. Formed by placing the trunks of saplings or young trees side by side across the line of roadway; resting them on supports or sleepers, and tying them down by side rails. The rough surface thus formed is often smoothed by placing smaller branches over them and covering them with earth. Hundreds of miles of this roadway were built during the Rebellion to pass wagons over marshy places otherwise impassable.

Cordylophora. See CLAVIDÆ.

Core. Mass of soft iron, either a solid piece or a bundle of wires, placed within coils of wire in most electrical apparatus. As the permeability of iron is very great, the strength of the field induced by its means is much increased.

Corea. Peninsula of e. Asia; area ab. 87,760 sq. m. In the interior is a mountain range, trending with the direction of the peninsula and occupying a large part of its area. The lower country is fertile and well cultivated. The king is absolute. Pop. ab. 14,000,000. Buddhism arrived early, but Confucianism



Corea.

has been the established creed since the 14th century. C. was invaded and mostly conquered by the Japanese 1597 in retaliation for previous hostilities, but abandoned the next year. From 1615 it paid tribute to Japan; from 1637, to the Manchu sovereigns of China. The policy of the nation has been one of absolute isolation. All attempts to Christianize C. have been met with repulse and persecution till within a very recent period. In 1875 three ports were opened to Japanese trade, and in 1882–86 treaties were made with China, the U. S., Great Britain, and other European powers. This more liberal policy led to insurrections in 1884 and 1894. The war of 1895 between Japan and China, fought out in part on Corean territory, resulted in breaking up the conservatism of C. and facilitated the introduction of Western ideas and methods.

Coregonus. Genus of isospondylous *Salmonidæ*, including the Whitefishes, of which *C. clupeiformis* is the common Whitefish of the Great Lakes. It has a small mouth, nearly

toothless, and is strongly developed over the neck. It spawns in Nov. and Dec. on rocky shores in pure clear water, is the finest flavored fish known, and attains a length of a foot. The Cisco is an allied, but smaller, species in Lake Michigan, also known as the Lake Herring, and sometimes as Whitefish. It stays at the bottom in deep water, appearing only at the spawning season. The food consists of minute *Crustacea*.

Corelli, ARCANGELO, 1653–1713. Italian violin virtuoso and composer, who founded the modern school of violin playing, and freed instrumental composition from the exclusive domination of counterpoint.

Corelli, MARIE, b. 1864 in Italy. English novelist. *Vendetta*, 1886; *Thelma*, 1887; *Barabbas*, 1893.

Coreopsis. Genus of showy, mostly yellow-flowered, herbs of the Composite family, natives of America, much cultivated for ornament; called also Tickseed.

Corf, or CORVE. Among English miners, a basket used in hoisting or carrying coal; also a small wagon for drawing minerals in underground passages.

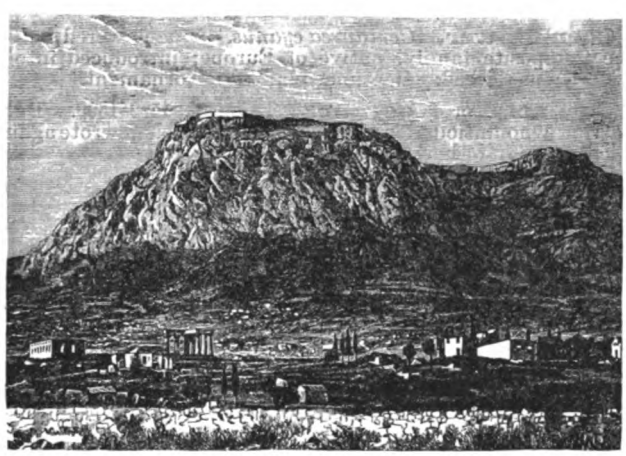
Corfu. See CORCYRA.

Coriander. *Coriandrum sativum.* Herb of the Carrot family, native of s. Europe, cultivated for its aromatic fruits.

Coriariaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledones*, comprising only one genus and ab. 4 species, dispersed through the regions bordering on the Mediterranean, in Japan, New Zealand, and Australia.

Corinna, ab. 500 B.C. Greek lyric poet.

Corinth. Ancient Greek city, on the isthmus; eminent for commerce, wealth, and luxury; destroyed by the consul Mummius 146 B.C.; rebuilt by Cæsar 46 B.C.; visited by St. Paul; seat



Corinth.

of the proconsul of Achaia: ravaged by Goths ab. 290, by Alaric 396, and by Slavs in 8th century; taken by Franks 1205, and by Turks 1459; held by Venetians 1699–1715, and again by the Turks till 1822; destroyed by an earthquake 1858. Pop. ab. 4,000.

Corinth. Capital of Alcorn co., Miss.; occupied by Confederate troops April 1862, and by Federal forces May 30. Here Gen. Rosecrans repelled a fierce attack by Van Dorn Oct. 3–4, 1862. Pop., 1890, 2,111.

Corinth, GULF OF, or GULF OF LEPANTO. Dividing Greece into two nearly equal parts; ab. 100 m. long.

Corinth, ISTHMUS OF. Connecting Hellas with Peloponnesus. The Ship Canal, 4 miles long, begun in April 1882, was opened Aug. 6, 1893, avoiding the dangerous voyage around the Morea, and shortening the time for steamships ab. 16 hours. See ISTHMIAN GAMES.

Corinthian Order. See ARCHITECTURE.

Corinthians, EPISTLES TO THE. Seventh and eighth N. T. books, written by St. Paul A. D. 57, vindicating his authority and giving various directions as to Christian life and worship. II. Corinthians is notable for the magnificent chap. xv. on the resurrection, and xiii. on charity.

Corinto. Port of n.w. Nicaragua with large trade and important railroad communications. The British seized the Custom House 1895 to enforce an indemnity, but the difficulty was pacifically settled in a few days. Pop. ab. 2,000.

Coriolanus, CAIUS MARCIUS. Legendary hero of Rome, so named from his valor at capture of Corioli; banished 491 B.C. He became general of the Volscians, and took many Roman towns, but was persuaded to spare Rome by his mother's reproaches and his wife's tears.

Corippus, FLAVIUS CRESCONIUS, ab. 580. African poet.

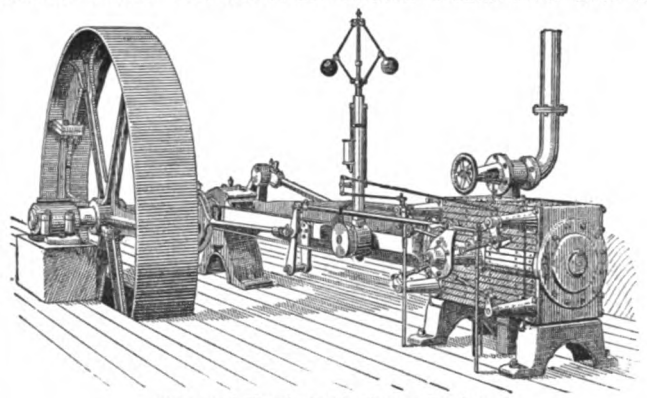
Corium. Deeper layer of the skin, beneath the epidermis, from which, in hides of cattle, leather is made.

Cork. Protective tissue developed in the bark of most *Spermatophyta*, consisting of tabular or cubical cells whose walls are suberized. The article of commerce is derived from the Cork Oak, *Quercus suber*, native of s.w. Europe and n.w. Africa. The ridged branches of the Sweet Gum are composed of this substance.

Cork. City of Ireland, on the Lee, 11 m. from Queenstown. It has considerable commerce and some manufactures. It was taken by Henry II. 1172, by Cromwell 1649, and by Marlborough 1690. Pop., 1891, 75,070.

Cork Wood. *Ochroma Lagopus.* Tree of the Mallow family, native of tropical America, producing a very soft, light wood, used for rafts or "balsas."—In Missouri, *Leitneria floridana*, a small tree whose wood is probably the lightest known.

Corliss Engine. Embodying in its valve gear the special features first applied by Geo. H. Corliss of Providence, R. I. These are: first, to secure an automatic adjustment of the point of cut-off as the speed varies with the load; second, to do this and secure constant compression and a fixed point of release at all points of cut-off; third, to secure a sharp cut-off with the least loss of pressure from the boiler. The cylinder has four valves, one for admitting and one for exhausting steam at each end. These are driven from four points on a vibrating wrist-plate operated from an eccentric by a rod. The two exhaust valves are driven from points which secure a prolonged opening; the steam valves are driven from points which have a rapid motion at the start, so as to admit abundance of steam. The valves are rotated around their axes to



Improved Harris-Corliss Steam Engine.

open and close the ports, but the valve proper is not rigidly secured to the spindle, so that it does not bind by unequal heating nor leak as soon as slightly worn. The abrupt cut-off is secured by releasing the link which drives the valve arm by a tripper or detent, so that it is disconnected from the wrist-plate motion, and the valve closes suddenly by a weight. The valve arm is connected to a dash-pot, by which too sudden jar in closing is avoided. The disengagement is affected by the governor at the point determined by the speed at that revolution. One of the most notable Corliss engines was the one exhibited at the Centennial Exhibition in Phila. 1876. This was rated at 1.400 h.p., but is capable of 1,800, and is now driving the car works at Pullman, Ill. It is a double engine, with cylinders 40″ dia. by 10-ft. stroke. A number of Corliss cylinders are in use 44 in. diameter, and 7 or 10-ft. stroke.

Corm. Very short, subterranean fleshy stem, as in Jack-in-the-Pulpit.

Cormology. That branch of Morphology which treats of the evolution of individuality of a higher order, due to the integration of zoöids. It starts with the simple gastrula and deals with the colonies of these as seen in the Cœlenterates, and with the strobilated or segmented forms presented by the other groups of animals.

Cormon, FERNAND, b. 1845. French painter, chiefly of ancient subjects.

Cormophytes. Plants which produce distinct stems.

Cormorant. See STEGANOPODES.

Cormus. Colony of animals united in a common extension of their bodies as in Hydroids, etc. Different forms of cormi are enumerated under BION (q.v.).

Corn. General name for cereal grains or cultivated grasses.

In Europe it is generally applied to Wheat (*Triticum*), in N. America to MAIZE (*Zea Mays*) (q.v.). See also GRAIN.

Corn. Thickening and hardening of the epidermis which presses upon the sensitive layers of the skin causing pain, denominated hard and soft, according to its density, the latter form being found between the toes. Usually occur upon the feet and caused by irritation of badly fitting shoes or stockings.

Cornaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledones*, comprising 16 genera and ab. 80 species, distributed throughout the world. Commonly called the Dogwood family.

Cornaro, CATERINA, 1454–1510. Venetian, Queen of Cyprus 1472–89.—Her relative LUIGI, 1467–1566, pub. 1550 a widely circulated *Discourse of Sober Life*.

Corn Chamomile. *Anthemis arvensis.* Weed, troublesome in wheat fields. It spreads chiefly from the seed, and where not too abundant may be kept in check by hand-pulling before the appearance of blossoms, which resemble the ox-eye daisy in form and color.

Corn-Cockle. *Agrostemma githago.* Tall purple-flowered weed common in European cornfields, to which it is harmful on account of the poisonous nature of the seeds.

Corn-Crake. *Crex pratensis.* Widely-distributed species of rail prized for the excellence of its flesh. About 1 ft. long, with long legs and short tail, its color tones from red to gray and it has a peculiar rasping cry. It is found in Central Asia and Africa and visits n. Europe in the summer.

Cornea. Transparent portion of the eye, convex on its outer surface, but concave on the inner, and continuous with the sclera at its margin.

Corneille, PIERRE, 1606–1684. French dramatic poet, founder and head of the classical school. His masterpieces are *Le Cid*, 1636; *Horace*, 1639; *Cinna*, 1639; *Polyeucte*, 1640; *La Mort de Pompée*, 1641; and *Le Menteur*, 1642. His tragedies are his best work, though his comedy is excellent.—His brother, THOMAS, 1625–1709, was also a dramatist.

Cornel. White-flowered shrubs of the genus *Cornus*, of the Dogwood family, natives of the n. hemisphere.

Cornel.

Cornelius. Roman centurion, received by St. Peter into the Church, without previously becoming a Jew, thus engaging St. Peter's authority to the subsequent labors of St. Paul.

Cornelius. Bp. of Rome 251–52; friend of Cyprian, and representative of the milder Roman discipline as against the Novatians.

Cornelius à Lapide, or VAN DER STEEN, 1568–1637. Belgian Jesuit, teacher at Louvain and Rome; commentator.

Cornelius, KARL SEBASTIAN, b. 1822. Prof. Physics at Halle. *Physical Geography and Climatology.*

Cornelius Nepos. See NEPOS.

Cornelius, PETER, 1824–1874. German musical composer of the Wagnerian school; author of *Der Barbier von Bagdad*, brought out by Liszt in Weimar 1858, songs for one voice, part-songs for mixed and men's voices, and a second opera, *Der Cid*, 1865.

Cornelius, PETER VON, 1783–1867. Leader of the German Romantic School in painting. He has important frescoes at Munich in the Glyptothek, Pinokothek, and Ludwig's Kirche; also compositions in the Campo Santo of Berlin.

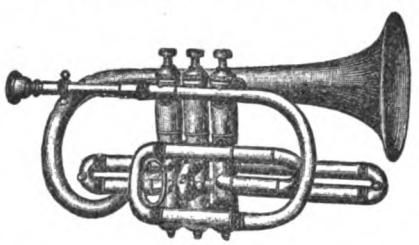
Cornell, EZRA, 1807–1874. Founder of Cornell Univ.—His son, ALONZO B., b. 1832, was Gov. of N. Y. 1880–82.

Cornell College. At Mt. Vernon, Iowa; organized 1857 by Methodists. Besides the usual courses it maintains musical, normal and preparatory departments. It has 28 instructors, ab. 250 collegiate students, and a total attendance of ab. 550.

Cornell University. At Ithaca, N. Y.; incorporated 1865, opened 1868. Ezra Cornell gave $500,000, and a land-grant came from the State through Congress. This latter was so managed that in ab. 10 years $5,000,000 was realized from the sale of lands. The Univ. has also been blessed with liberal friends and patrons. In 1894 it had 145 instructors and 1,801 students, of whom 225 were women, and 255 were candidates for advanced degrees. Besides courses in arts, science, letters, philosophy, and agriculture, there are colleges of civil engineering, and of mechanical and electrical engineering, and a school of law. The univ. occupies extensive grounds above Cayuga Lake, has a library of 160,000 vols., and offers many prizes in the form of valuable fellowships and scholarships.

Corner (IN ECONOMICS). Temporary monopoly, created with the expectation of selling the article held at an advanced price.

Cornet. A musical instrument of the trumpet kind, with cupped mouth-piece, convoluted tube ab. 8 ft. long, valves, and



Cornet.

bell. Crooks of various sizes are used to change its key by lengthening or shortening the tube. It frequently takes the trumpet's place in modern orchestras.

Corneto. Tuscan town, near the site of the ancient Tarquinii, with many interesting Etruscan tombs. One of the treasures of its museum is a set of ancient false teeth. Pop. ab. 6,200.

Corn-Flower. *Centaurea cyanus.* Blue-flowered herb of the Composite family, native of Europe; introduced into N. America as a weed; sometimes planted for ornament.

Cornhert, or **Koornhert,** DIEDRIK, 1522–1590. Dutch patriot, who anticipated the Arminian tenets, and wrote against the execution of heretics.

Cornice. In classic architecture, upper member of an entablature; in modern, projecting course or courses at the top of a wall, which it protects from rain; also introduced as a decorative feature between the stories.

Cornicula, or CORNICLES. Horn-like processes on the abdomen of the Plant-Louse, serving for the passage of the sweet fluid relished by Ants.

Corniferous. Oldest Devonian Limestone in America, so named by Prof. Hall in consequence of the large quantity of flint or horn-stone found in its outcrops in N. Y.; also called the Upper Helderberg. See DEVONIAN.

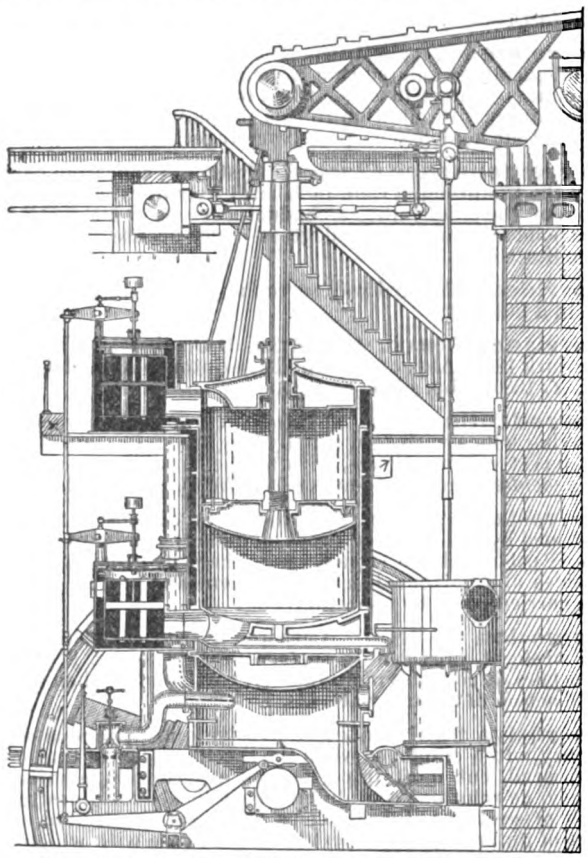
Corn Insects. More than a hundred species belonging to nearly all orders of Insects, infest corn; the worst are common enemies of several cereals, such are the Plant-lice, Chinch-bug, Cutworms, etc. A beetle (*Diabrotica longicornis*) feeds on the silk and pollen while its larva bores into the roots. Most of the Cutworms work under or on the ground, but one species bores into the stem near the top and another feeds on the kernels in the milky stage.

Cornish. Extinct branch of the Celtic family of languages, spoken in Cornwall till ab. 1750. See CELTIC.

Cornish Boiler. Boiler with one large internal flue in the water-space. This flue (of ab. $\frac{6}{10}$ of the diameter of the shell) contains the fire-box or furnace; the products of combustion pass back through the flue, come forward at the sides of the shell, and return to a chimney at the rear by passing underneath the bottom. The large flue, exposed to collapsing pressure, has to be strengthened (as by Adamson's seam and the Bowling ring): the higher modern pressures have compelled the use of two flues side by side, and separate fire-boxes. This boiler is economical from diminished losses by radiation, and is especially applicable for long flaming coals. The danger from collapse of flues limits its use to the lower pressures.

Cornish Engine. Single acting engine first used in the Cornwall mines, and since extended to all classes of pumping. There are two forms, the beam engine, and the Bull engine, in which the axis of the cylinder is in the prolongation of the pump-rods and over the shaft or well. The engine lifts the rods or plunger, and the latter by their weight raise the column of water. The Cornish cylinder has three valves: one lets in steam at one end; the second lets steam out into the condenser at the other; the third, called the equilibrium valve, connects the upper and lower ends through an exterior pipe. The first

and second are both open, the third is closed, during admission; the expansion is effected after closure of the first. This is the stroke which lifts the weight of rods or plungers; the amount of steam can be so proportioned to the mass to be moved that in an engine without crank or fly-wheel the piston will not strike either top or bottom cover of the cylinder. On the return stroke, the first and second valves are both closed, and the third is open, by which equilibrium is established above and below the piston, and the rods sink at graduated speed. Such



Pumping-Engine of the Lehigh Zinc Co., Friendensville, Pa.

engines have given very economical duties, but their great size and weight for work of any magnitude, and the great cost of their foundations, prevent their extended use. The large Cornish pumping-engine at Friedensville, Pa., has a cylinder 110¼" in diameter by 10-ft. stroke.

Cornish Pump. See CORNISH ENGINE.

Cornish Valve. First used in connection with the deep mine pumps in Cornwall. It is arranged to have two seats, and two valve disks or cages one above the other, so that the pressure of the fluid column comes below one valve and above the other. These pressures can be made to balance each other, and hence the valve as a whole lifts more easily and seats more quietly. This form of valve has been much used in large water works and mining practice.

Corn Laws. Import duties or export bounties on grain, with the object of supporting home production and agricultural prosperity. The English Corn Laws were imposed 1816 and abolished 1846.

Corn Salad. *Fedia* or *Valerianella olitoria.* Herb of the natural family *Valerianaceæ*, native of Europe, introduced into N. America, cultivated for salad; known also as Lamb-lettuce and Fetticus.

Cornua Trabeculæ. Paired anterior processes of the trabeculæ cranii, which underlie the nasal region and embrace the pituitary space.

Cornutus, L. ANNÆUS, 1st century. Roman stoic, who wrote in Greek.

Cornwall. S. w. county of England, noted for its mines and monuments. Here the Phenicians came for tin.

Cornwall, BARRY. See PROCTER, BRYAN W.

Cornwallis, CHARLES, MARQUIS, 1738–1805. British general in command during the Revolutionary war. His surrender at Yorktown, Oct. 1781, marked the fall of the English cause in the U. S. He was Gov. of Bengal 1786–93, Lord-lieut. of Ireland 1798, and Gov. of India 1805.

Corolla. Inner of the two floral envelopes of a flower.

Corollary. Inference from a proposition in mathematics, so clear as to need no demonstration.

Corolliflorae. Division of monocotyledonous plants, bearing showy flowers resembling the corollas of some dicotyledons.

Corolliflora. Flowers having the stamens inserted on the corolla.

Coromandel Coast. On s. e. of British India, a strip of ab. 350 m. in Madras. The coast is an open roadstead with no harbors of refuge, and the heavy surf makes landing difficult.

Corona. Outgrowth from the corolla, as in the Passion-flowers and some Pinks.—In architecture, vertical face of a cornice, under the projecting moldings.

Corona, SOLAR. Appendage surrounding the sun and extending on all sides to a great distance. Individual streamers have been traced of 9,000,000 miles in length, though usually 400,000 or 500,000 is more nearly the limit. It is never visible except during a total solar eclipse, the sun's light at other times overpowering it.

Coronach. Funeral lament, once common in the Scottish highlands and in Ireland.

Coronado, FRANCISCO VASQUEZ DE, ab. 1510–1542. Spanish explorer in New Mexico 1540–41.

Coronation. Crowning of a monarch; sometimes deferred till months after his accession, and of ceremonial rather than legal importance.

Coroner. Officer whose original duties were to keep the pleas of the crown, and thus to limit the power of the sheriff. In the U. S., his principal function is to inquire into the causes of sudden and violent death. His appointment and duties are generally regulated by statute.

Coronet. Minor crown used by English peers since ab. 1330, and by nobles of other lands in various forms.

Corot, JEAN BAPTISTE CAMILLE, 1796–1875. French landscape painter, one of the greatest of his time. His pictures are largely owned in America, and have been extensively counterfeited. He preferred effects of cloudy and misty days.

Corpancho, MANUEL NICOLAS, 1830–1863. Peruvian poet and dramatist.

Corpora Bigemina. Mid-brain lobes of Vertebrates below Mammals. In Mammals they are represented by the corpora quadrigemina.

Corporal. Lowest grade of non-commissioned army officer. A lance corporal has temporary position and is selected by his captain; a corporal is appointed by the colonel on the captain's recommendation.

Corpora Striata. Masses of gray nerve matter, one in each lateral half of the brain.

Corporation. Artificial person created by law, possessing such attributes and powers as the law confers; in the U. S. generally created by legislative act. Public corporations are organized for governmental purposes; all others are private.

Corporation Pictures. Old Dutch paintings of guilds and associations. Famed examples are the series at Harlem by

The Master Weavers, by Rembrandt. Amsterdam Gallery.

Franz Hals, and the *Anatomy Lesson* and *Night Watch* by Rembrandt.

Corps. Body of troops, or of officers, as the corps of cadets at West Point. An army corps is the largest single organization of troops less than an army. It consists of infantry, cavalry and artillery, united under a single commander.

Corps Legislatif. French lower house 1852–70.

Corps of Engineers. Body whose duties comprise reconnoitering and surveying for military purposes; selection of sites and formation of plans and estimates for military defenses; construction and repair of fortifications; planning and superintending of defensive or offensive works of troops in the field; examination of routes of communications for supplies and for military movements, and construction of military roads and bridges; execution of river and harbor improvements assigned to it, and such other duties as the President may order. Its organization contains 1 chief engineer (brigadier-general), 6 colonels, 12 lieutenant-colonels, 24 majors, 30 captains, 26 first lieutenants, and 10 second lieutenants, and a battalion of engineer troops comprising 4 companies, aggregating 500 enlisted men.

Corpse Plant. See INDIAN PIPE.

Corpus Adiposum. Fat body in Frogs, connected with the generative organs.

Corpus Callosum. Mass of white nerve tissue which unites the two halves of the cerebrum.

Corpus Christi. R. C. festival, Thursday after Trinity, in honor of the Eucharist, established 1264. It is customary then to carry the Host in procession.

Corpuscle. Any minute round or oval body; more especially the cellular elements of the blood.

Corpuscular Theory. One of the early theories of light, associated with the names of Newton, Laplace, and Biot. It supposes light to consist of particles moving from external objects to the eye. According to this theory, the sensation of light is produced by the impacts of these material particles on the retina. It has long since been shown to be inconsistent with observed phenomena. It is known as the emission theory, as luminous objects were supposed to send out the light particles in all directions.

Corpusculum. Organ connecting the reticacula, which carry the pollen masses, in the natural family *Asclepiadaceæ*.

Corpus Luteum. Yellowish body on the ovary at the point from which an ovum has issued. It remains for ab. 10 months if pregnancy has occurred, and not more than 2 when it has not.

Correggio, ANTONIO ALLEGRI, 1494–1534. Italian painter, one of the five greatest painters of his period, the others being

Mystical Marriage of St. Catherine.

Da Vinci, Raphael, Michelangelo, and Titian. His technical forte was chiaroscuro (light and shade). His choice and treatment of subjects tended to the graceful, beautiful, and realistic rather than to the intellectual, sublime, or decorative. His greatest works are oil paintings, as distinct from frescoes, although he has in Parma important mural paintings. Among his oil paintings are: *Holy Night* in Dresden; *Antiope* and *Mystical Marriage of St. Catharine*, in the Louvre; *Education of Cupid*, in the National Gallery; *Leda and the Swan*, and *Io and Jupiter*, in Berlin (a finer replica of the latter in Vienna); *Danäe*, in the Borghese Gallery, Rome; *Repose in Egypt*, and *Madonna Adoring the Infant Saviour*, in Florence. The *Magdalen*, in Dresden, is no longer attributed to him.

Correlated Variation. The organs of the body are physiologically so related that a change in one part necessitates and induces change in other parts to keep up the equilibrium of adaptation. In addition to this physiological correlation it is found that homologous parts vary together.

Correspondence Classes. System of education carried on by the Chautauqua Coll. of Liberal Arts by which able professors of the chief colleges conduct a course of instruction by correspondence and confer degrees under license by the Univ. of the State of N. Y.

Corridor. Covered way surrounding a fortification. Passage in a building.

Corrigan, MICHAEL AUGUSTINE, D.D., b. 1839. R. C. Bp. of Newark 1873; Abp. of Petra and coadjutor to Abp. McCloskey of N. Y. 1880; Abp. of N. Y. 1885.

Corrodentia. Tribe of *Pseudo-neuroptera*, characterized by having wings with few, usually longitudinal nervures. The head has strong mandibles, with toothed internal edges. Booklice (*Psocidæ*), and White-ants (*Termitidæ*), are included.

Corrosion. That part of the work of erosion which is performed by solid matter swept along in the water of streams, such as pebbles, loose stones, etc. These by grinding against the sides and bottom disintegrate them and provide material to be carried down by the water.

Corrosion of Iron. Cast-iron resists corrosion better than wrought, provided its surface or skin is not broken; if this occurs, it corrodes more rapidly, particularly when subject to the action of impure waters.

Corrosive Sublimate. Corrosive and poisonous salt of mercury, often employed when the specific effects of that metal are desired, but most important as a germicide in antiseptic surgery, as solutions containing 1 part in ab. 2,000 destroy all forms of germs; not desirable as a general disinfectant on account of its poisonous properties and the ease with which it is decomposed by ammoniacal bodies. See MERCURIC CHLORIDE.

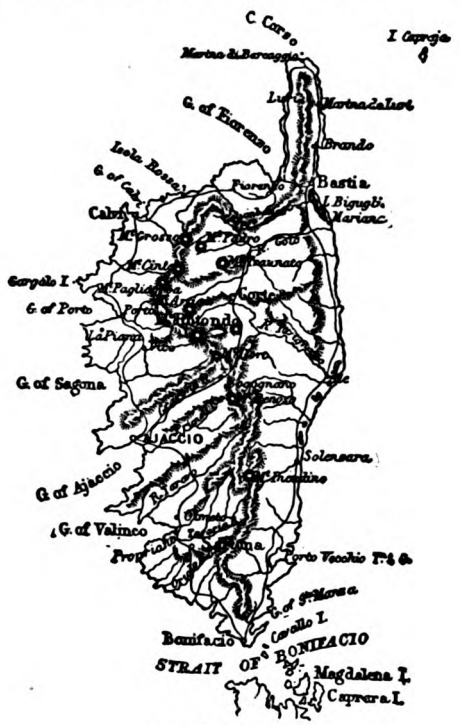
Corrugated Flues. Flue for boilers, in which the metal is formed into alternate ridges and hollows, so that greater stiffness against collapse is secured, with greater lengthwise flexibility to yield to strains of expansion. Many of the newest marine boiler flues which are exposed to the high pressures now carried are made in this way.

Corrugated Iron. Iron rolled in thin sheets with sidewise waves so as to render it stiff. It is used for the covering of roofs and buildings, and is not liable to warp or twist, while, if kept properly painted, it is very durable. It is stiffer against deformation by wind than flat sheets would be, and can be laid like shingles with diminished likelihood of leakage at the sides and edges. It makes also a fire-proof sheathing.

Corsairs. Turks who from ab. 1510 held the Barbary States, and thence ravaged the coasts of the Mediterranean and intercepted its commerce. Barbarossa was destroyed by the Spaniards under Comarés 1517; his brother Kheyreddin, d. 1546, was made Gov. of Algiers by Sultan Selim, and later Turkish admiral. Charles V. made expeditions against him 1535 and 1541. The Turkish fleet was destroyed at Lepanto 1571, but the Corsairs long continued their depredations, and exacted tribute from the Christian powers. The U. S. were the first to resent these exactions by an attack upon Tripoli under Decatur 1804. A treaty was concluded with the Dey, by which American ships were to be exempt from this tribute in consideration of a lump sum of $60,000. The power of the Corsairs was broken by the English in the Battle of Algiers 1816; but it was not till Algiers was annexed by the French, 1830, that piracy and Christian slavery ceased.

Corsica. Island in the Mediterranean w. of Italy belonging to France since 1768; 114 miles long by 52 broad; area 3,378 sq. m.; pop., 1891, 288,596. It was gained from the Carthagenians by the Romans ab. 238 B.C., fell to the Saracens in the 8th century, in the 11th to Pisa, and in 1481 to Genoa. It is mostly mountainous; the alluvial plains on the east side are nearly de-

serted in summer because of malaria. It is noted as the home of the vendetta and the birth-land of Napoleon.



Island of Corsica.

Corsinieæ. Small family of *Hepaticæ*, of the order *Marchantiaceæ*.

Corsini Gallery. At Rome, in the Corsini Palace; founded by Clement XII. (1730–40). It contains few paintings of great merit, but is one of the sights of the city.

Corsite. Name occasionally given to a mineral found on the island of Corsica, consisting chiefly of anorthite-feldspar and hornblende. Variety of Diorite.

Corssen, WILHELM PAUL, 1820–1875. German philologist best known for his works on the *Pronunciation of Latin*, 1858, and *Etruscan Language*, 1874.

Cort, CORNELIS, 1536–1578. Dutch engraver, resident from 1572 in Italy, where he exerted great influence on art.

Cort, HENRY, 1740–1800. English iron-master who invented the puddling furnace and grooved puddle rolls for drawing puddled ball into bars ab. 1784.

Cortes. Legislature of Spain, composed of a Senate and Chamber of Deputies; also of Portugal.

Cortes, HERNANDO, 1485–1547. Spanish conqueror of Mexico. He entered the city Nov. 1519; imprisoned Montezuma in his palace; defeated his rival Narvaez 1520; returned to the capital, where his lieutenant Alvarado was besieged, June 24; left it after a week of constant fighting, and lost most of his troops in the terrible *noche triste*, July 1; by aid of the Tlascalans besieged the city, which fell Aug. 13, 1521; was Gov. of New Spain 1522–28, and captain-general till 1540; made many explorations and discoveries, including Lower California, and spent his last years in Spain.—His son, MARTIN, 1532–1589, had large estates in Mexico.

Cortes, JOSE DOMINGO, ab. 1830–1884. Chilian historian and compiler.

Cortex. Exterior layer or layers of cells in the stem or thallus of the lower plants, analogous to the bark in those of higher organization. Also the outer layers of the bark.

Cortex of a Sponge. Special tough outer layer of mesoderm, containing desmacytes, and in which no ampullæ are developed, though subdermal chambers may be present.

Corthell, ELMER LAWRENCE, b. 1840. Civil engineer in charge of construction of the jetties at the mouth of the Mississippi R., and of many railroads and bridges. Author of *The Mississippi Jetties*, 1880.

Corti, ORGAN OF. Peculiar auditory epithelium resting on the basilar membrane of the cochlea of the internal ear, and projecting into the canalis cochlearis. (See COCHLEA.) The cochlear branch of the auditory nerve terminates in the cells of this organ, which is supposed to play an important part in the reception of auditory stimuli.

Cortical. Pertaining to the cortex of plants.

Corticata. Grade of *Protozoa*, including forms furnished with a fixed ectosarc. It includes the *Sporozoa* and the *Infusoria*.

Corticolous. Plants growing on the bark of trees or shrubs, as many Lichens and Fungi.

Cortina. Remnant of the volva occurring as a membrane around the edge of the pileus in some toadstools.

Cortona, PIETRO DA, 1596–1669. Italian painter, active mainly in church decoration; an artist of talent and dexterity

Pietro da Cortona.

in execution, but superficial in thought and theatrical in manner.

Corundum. Al_2O_3. Mineral consisting of aluminium and oxygen, next to diamond in hardness. The highly-colored, transparent varieties rank as precious stones under the names sapphire, ruby, topaz, amethyst, and emerald. When occurring mixed with magnetite, it is known as emery, the chief supply of which comes from the Grecian Archipelago and Asia Minor.

Corunna. Seaport of n. w. Spain. The *Armada* sailed hence 1588, and here 14,000 British in retreat under Sir John Moore repulsed 20,000 French under Soult Jan. 16, 1809; Moore was slain. Pop. ab. 36,000.

Corve. See CORF.

Corvette. Formerly a vessel of war, flush-decked, and either ship- or barque-rigged, having fewer than 20 guns all in one tier. The term is now obsolete, being supplanted by cruiser.

Corvey. Benedictine abbey in Westphalia, once center of the Saxon and Scandinavian missions, and later of German learning. It lasted in full glory from 822 till the Thirty Years' War, but was destroyed 1632.

Corvidæ. See DENTIROSTRES.

Corvinus, MATTHIAS, 1443–1490. King of Hungary 1458; son of Hunyades. He fought the Turks, and took Moravia and Vienna.

Corwin, THOMAS, 1794–1865. M. C. 1831–41, and 1859–61; Gov. of Ohio 1841–43; U. S. Senator 1845–50; Sec. Treasury 1850–53; Minister to Mexico 1861–64.

Coryat, THOMAS, 1577–1617. English traveler; author of *Crudities*, 1611.

Corybantes. Priests of Cybele, in Phrygia, noted for their wild dances.

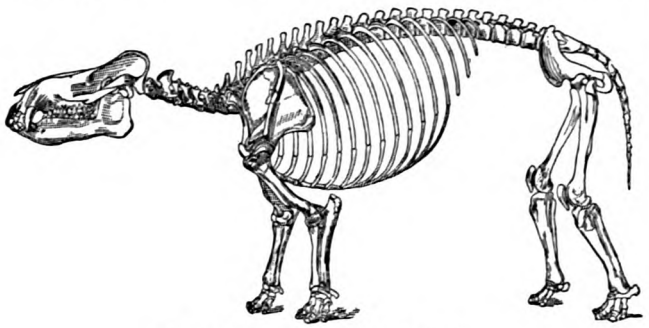
Corymb. Flower-cluster having a slightly elongated axis, the lower flowers borne on longer pedicels, resulting in a flat or convex cluster, as in certain species of *Spiræa*.

Corynida. Gymnoblastica or Tubulariæ.

Coryphæna. See ACANTHOPTERI and DOLPHIN.

Coryphæus. Leader of the chorus in an Attic drama; hence, leader in any movement.

Coryphodon. Large Eocene quadruped of generalized



Restoration of Coryphodon Hamatus.

type of the w. States, with short limbs, elephantine feet, bear-like canine teeth, and exceedingly small brain.

Coryphodontidæ. Family of *Perissodactyla*, comprising a number of Tapir-like fossil Ungulates of the Eocene period. All the feet were five-toed; each toe carried a hoof. The dentition is complete; 44 teeth were present. The group is associated with the *Dinocerata* by Prof. Cope, under the order *Amblypoda*, sub-order *Pantodonta*.

Cosa, Juan de la, ab. 1461–1509. Spanish pilot, who sailed with Columbus 1493, Ojeda 1499, and others. He made the first known map of the New World 1500.

Cosecant. A trigonometric function, ratio of the distance of any point, on the terminal line of an angle, from the vertex to the ordinate of that point. It is the reciprocal of the sine.

Cosin, John, 1594–1672. Bp. of Durham 1660. He wrote histories of the Canon of Scripture 1657, and of Transubstantiation 1675, besides *Private Devotions*, 1627.

Cosine. A trigonometric function; ratio of the abscissa of any point on the terminal line of the angle (rectangular axes) to the distance of that point from the vertex of the angle.

Cosmas, St., "the Melodist," d. ab. 760. Greek hymnist; Bp. of Maiuma 743.

Cosmati, The. Family of mosaic decorators, active in Rome and s. Italy, ab. 1180–1250. As distinct from the glass used for Byzantine mosaics, the material they mainly employed was colored stone and marble, obtained from ancient ruins; the designs were linear or diapers. The decoration was used for pulpits, altars, pavements, etc.

Cosmetics. Preparations for beautifying the face and skin. The custom of blackening the edges of the eyelids and brows was common to the ancient Egyptians, Greeks, and Romans, and is still general in the East; antimony, manganese, lead, burned almonds, or frankincense, being variously used. Among the Assyrians the men carried the arts of the toilet further even than the women of other countries, and Absalom's effeminacy shows how the Jews copied them. The luxurious Athenian ladies also whitened their foreheads, blanched their teeth, reddened their lips and cheeks, and glazed their whole face with white of egg. Froth of snails was used for freckles and Chian and Selinusian earths for wrinkles. Elm-juice and almond-paste cleared the skin, and the body was sprinkled with powdered rose leaves on leaving the bath. The Romans paid equal attention to the complexion. Nero's wife, Poppea, spent prodigious sums on washes and ointments and never traveled without 500 she-asses to supply her baths with milk. The satirists of the Middle Ages speak of strange and horrible preparations. Blood was an efficacious beautifier, and the ladies of Charles II.'s court washed their faces sometimes with Maydew but oftener with crude quicksilver. It is, however, doubtful if the use of deleterious cosmetics was ever more general than at the present day. For whitening the skin, prepared chalk, magnesium carbonate and subnitrate of bismuth are used; for heightening the color various lakes, chalk colored with carmine or other red pigments are sold as rouge; for blackening the eyebrows, black pomades.

Cosmical. Relating to creation at large, as distinguished from terrestrial, which relates merely to the earth. A cosmical phenomenon is one which has its origin outside the earth's atmosphere.

Cosmogony. The theory most commonly held in explanation of the origin of the universe is the nebular hypothesis in some of its forms. This supposes the matter forming the solar system and other similar systems to have existed formerly in a rarefied condition either as a gas, or a cloud of cosmic dust, or meteoric bodies. The effects of motion, of generation of heat by condensation or collision in accordance with known physical laws, will explain much if not everything.

Cosmoline. See Vaseline.

Cosmology. Science of the structure and laws of the universe, and only indirectly includes problems of cosmogony.

Cosquin, Emmanuel, b. 1841. French writer, chiefly on folk-lore. *Contes de Lorraine*, 1886.

Cossacks. Nomadic shepherd tribes of southern Russia, of Mongolian descent, but speaking Turkish dialects. They are light-complexioned, delicately formed, with almost European features. They were first heard of in the 10th century. In the 15th they formed a strong military confederacy, and gained

Cossack.

many victories over Turks and Tartars. There are two main divisions; those of Little Russia, near the Dnieper, and those of the Don, on the Volga, in Astrakhan, about the Ural, and in Siberia. The latter supply a large contingent of cavalry to the Russian army, and give name to a province of 61,886 sq. m. and ab. 1,900,000 inhabitants.

Cosson, Ernest, M.D., b. 1819. French botanist. *Flore des Environs de Paris*, 1845–61, with A. Weddell; *Flore d'Algérie*, 1854–67, with Durien de Maisonneuve.

Cossova. Plain on the frontier of Servia. Here Turks defeated Christian forces Aug. 27, 1389, and Oct. 19, 1448.

Costa. First vein of an insect's wing close by the anterior (or external) margin.—Also the vein of the leaf in mosses.

Costa. Claudio Manuel da, 1729–1789. Brazilian poet.

Costa, Lorenzo, 1460–1535. Italian painter, of the Ferrara school.

Costa, Michael, 1810–1884. Musical composer and conductor, of Italian birth and Spanish ancestry, in England from 1829; knighted 1869. His oratorios, *Eli*, 1855, and *Naaman*, 1864, are his best works.

Costæ. Vertical ridges on the surface of the theca of corals.

Costa Rica. State of Central America, s. of Nicaragua, extending from the Caribbean Sea to the Pacific. Area ab. 23,000 sq. m. It has large mineral resources, as yet little developed, though gold was discovered 1823. Under Spanish rule it was attached to Guatemala. It formed a part of the Central American Federation 1824–48, and has since been independent; capital San José. Pop. 1892, 266,161.

Costeaning. Cornish method of searching for mineral veins by sinking shallow shafts and connecting them by horizontal drifts or open cuts.

Costello, Louisa Stuart, 1799–1870. English novelist and descriptive writer; pensioned 1852.

Coster, Laurens Janszoon, ab. 1400–ab. 1485. Dutch claimant of the invention of printing.

Costha-ben-Louka. See Kosta.

Cost of Production. Sum of the exertions of all the different kinds of labor involved in making an article, with the abstinences required for saving the capital used in its produc-

tion. The money cost, or Expenses of Production, is the sum of the prices that have to be paid for these efforts and abstinences.

Costs. Expenses of a suit allowed by the court to the successful litigant, counsel's fees not being included in the term.

Costume. In ancient Egypt, costume was simple in form, consisting principally of a sleeveless, sashed, fringed skirt, and a profusion of necklets, armlets, anklets, bracelets and rings. The women added jeweled head-dresses, bands and girdles. The Assyrians, somewhat similarly robed, carried ornamentation to still greater excess. Greek costume was regulated by the same laws of taste that prevailed in sculpture and painting. Both sexes draped rather than dressed. The loot of the Persian camps inspired later luxury. The Ionians wore vests and robes of white, violet, crimson, purple, or saffron sprinkled with dusky lozenges. The hair blazed with jewelry. From Corinth were obtained tunics of costly dye, hyacinthine or violet, flame-colored or deep sea-green, while Persia supplied still more superb mantles and tunics, and women of fashion were reproached with wearing gossamer textures of "woven air." Twenty-two varieties of shoes were also worn. In Rome, where the toga was the national dress, distinction was sought in rich material. Babylonian embroidered stuffs, Egyptian cottons and linens, Tyrian dyed woolens, and Indian and Chinese silks were prized. Nero first assumed Oriental robes, and, like Heliogabalus, never wore the same dress twice. The barbarians introduced trousers and revolutionized costume, which, for the next ten centuries, was modified by the requirements of defensive armor. The simplicity of the Franks was soon corrupted by their conquests, and Charlemagne's own daughters were the first to break his sumptuary laws. The Normans degenerated into such foppery as to call forth ecclesiastical censure. Armorial bearings, the heraldic coat, and the novelties introduced by the Crusaders affected the costume of the 13th, 14th, and 15th centuries. Many sumptuary laws were enacted, not so much to restrain extravagance as to preserve the distinction of dress and render it a visible index of rank. The Italian conquests of Charles VIII., 1492, made the rich costumes of the maritime republics the European standard of fashion until France assumed the lead under Louis XIV. Male costume continued as varied and picturesque as female till the early 19th century, when it lost all color and vitality. Ecclesiastical costume has alone remained stable for any length of time, even the Protestant Church retaining the garb of the early Reformers.

Cotangent. A trigonometric function; ratio of the ordinate (rectangular axis) of any point on the terminal line of an angle to the abscissa of that point, referred to the initial line; reciprocal of the tangent.

Cotelier, JEAN BAPTISTE, 1627–1686. Editor of the Apostolic Fathers 1672; prof. Paris 1676.

Cotes, MRS. EVERARD. See DUNCAN, SARA J.

Cotes, ROGER, F.R.S., 1682–1716. English mathematician, Prof. Cambridge 1706; *Works*, 1722.

Cotes' Theorem. Geometrical method of factoring $a^n + x^n$ and $x^n - a^n$, when n is an integer. Describe a circle with radius a, and, fixing a diameter, divide the circumference into 2n equal parts. On the diameter lay off from the center O a distance O P = x; from P draw lines to the divisions of the circumference. Considering the distance from P to the circumference as the first in order, the odd-numbered lines will as factors form $a^n - x^n$ or $x^n - a^n$, as P is within or without the circle; the even-numbered lines as factors will form $a^n + x^n$. The lines can be determined trigonometrically in terms of x, a, and functions of the known arcs.

Cotgrave, RANDLE, ab.1570–ab.1640. Compiler of the first French-English dictionary, 1611–32.

Co-Tidal Lines. Lines drawn on the earth's surface through the points where high water occurs at the same instant.

Cotillon. Originally a lively French dance of four couples somewhat resembling a quadrille. The modern cotillon is merely a waltz of elaborate variations and intricacies in great favor in modern ball-rooms. It is called the German, when gifts are interchanged by the dancers.

Cotopaxi. Volcanic peak of the Andes in Ecuador; altitude 19,600 ft.

Cotswold. See SHEEP.

Cotta, CARL BERNHARD VON, 1808–1879. Prof. of Geology at Freiberg from 1842; writer on the phenomena of ore-deposits. *Erzlagerstättenlehre*, 1855; *Geologie der Gegenwart*, 1866. His geological maps showed the first exact and systematic national surveys made on the continent of Europe.

Cotta, GIAN BATTISTA, 1668–1738. Italian lyric poet; prof. at Florence. *Dio, Sonnetti, et Inni*, 1709.

Cottabus. Game at drinking parties in Greece, each player flinging a little wine from his goblet in as high a curve as possible into another vessel without spilling.

Cotter. See GIB.

Cotterill, THOMAS, 1779–1823. English hymnist. His *Selection*, 1819, in which James Montgomery helped, exerted great influence, though it was withdrawn in consequence of a lawsuit.

Cottidæ. Family of acanthopterygian fishes, including the Sculpins and Miller's Thumbs. The body is scaleless, the head

Miller's Thumb (*Cottus gobio*).

large, sometimes spiny. The Sculpins have large pectoral fins, and are marine. The Miller's Thumb is a fresh-water fish of small size.

Cottiers. Small tenant farmers, the conditions of whose tenure and amount of whose rent are determined not by custom but by competition; until recently common in Ireland.

Cottin, MME. SOPHIE (RISTAUD), 1773–1807. French novelist, m. 1790. Left a childless widow at 20, she sought occupation in writing, and won fame by her last book, *Elizabeth, or the Exiles of Siberia*, 1806.

Cottle, JOSEPH, 1770–1853. English publisher and poet, connected with Coleridge and Southey. *Recollections*, 1837–47.

Cotton. Herbs of the genus *Gossypium* of the Mallow family, natives of warm countries; cultivated from prehistoric times for the strong hairs attached to their seeds, which compose the commercial substance. There are several species and many varieties of the plant. Most of the crops of U. S. are

Cotton (*Gossypium barbadense*).
a, ripe capsule after dehiscence; *b*, a seed; *c*, the same deprived of its hairs.

varieties of *G. barbadense*, the Sea Island cotton, grown upon the lowlands of Fla., Ga., and S. C.; being the finest variety. The cultivation is largely by negroes on rented patches of ground and with all degrees of culture, mostly bad. The plant

will, however, fully repay the most careful culture, which is not essentially different from that given corn. If the stalks and seed are returned to the soil, almost no fertility is removed from the land.

Cotton Crop of U. S. 1894. Bales of 500 lbs. each. Value $259,164,640.

Alabama	854,122	Mississippi	1,167,881
Arkansas	709,722	Missouri	24,114
Florida	48,005	N. Carolina	454,920
Georgia	1,183,924	Oklahoma	13,001
Indian Ter.	104,887	S. Carolina	818,330
Kansas	67	Tennessee	286,630
Kentucky	2,685	Texas	3,073,821
Louisiana	721,591	Virginia	12,735
		Total	9,476,435

The cotton consumed in the civilized world is mostly grown in the four countries mentioned below, and, in 1890, in the following quantities, in bales of 500 lbs.

United States	8,632,088
India	2,404,202
Egypt	757,485
Brazil	291,765
	12,085,540

Cotton, CHARLES, 1630–1687. English poet, who parodied Virgil and Lucian, tr. Montaigne, and wrote part of Walton's *Complete Angler.*

Cotton, JOHN, 1585–1652. Puritan minister, who emigrated 1633 and became pastor at Boston and "patriarch of New England." He wrote near 50 vols., and had a controversy with Roger Williams.

Cotton, NATHANIEL, M.D., 1707–1788. English poet: *Visions,* 1751. Cowper was under his charge 1763.

Cotton, SIR ROBERT BRUCE, 1571–1631. English antiquary and collector. His library, increased by his son and grandson, and full of valuable State papers, was made public property 1730, and placed in the British Museum 1757.

Cotton Blue. Sodium or other salt of triphenylrosaniline, or pararosaniline disulphonic acid, prepared by the action of sulphuric acid on triphenylrosaniline; blue powder, soluble in water; called by a variety of names, as soluble blue and China blue; the common soluble aniline blue.

Cotton Caterpillar. *Aletia argillacea.* Hatched from eggs laid on under side of leaf of cotton-plant. When twenty days old, rolls itself up in leaf, and ten days later appears as a

Cotton Caterpillar (*Aletia argillacea*).

nocturnal moth, light-brown, over an inch across wings, on which are a dark central spot and three small white spots, also wavy lines. Each female lays nearly 200 eggs. Use arsenites or kerosene extract of pyrethrum.

Cotton Gin. Machine for clearing cotton from husks, seeds, and other impurities. Invented by Eli Whitney 1792. It consists of a series of circular saws mounted on a frame; nearly in contact with it rotates another cylinder mounted with brushes. The cotton is cut from the seeds by the saw-teeth, from which the brushes remove it.

Cotton Grass. Sedges of the genus *Eriophorum,* inhabiting bogs throughout the n. hemisphere. *E. cyperinum* is known also as Wool Grass.

Cotton Manufactures. The spinning of cotton yarn and manufacture of cloth have been practiced from remote antiquity. Herodotus refers to the cotton of India and also states that the Indian contingent of Xerxes' army wore cotton drawers. It was known in Arabia in the time of Mahomet 627, and brought to Europe by his followers. The 10th century saw it introduced into Spain, the 13th into China, and the 14th into Italy. In the 17th century cotton fabrics were so largely imported into England from India as to interfere with the linen, woolen, and silk interests, and the importation of cotton goods was forbidden by an Act of Parliament in 1700. It imposed a fine of £5 on the wearer of cotton and £20 on the vender. The progress of a bale of cotton to the condition of thread or yarn may be stated as follows: 1. Sorted and mixed, to give a uniform quality. 2. Scutched or Willowed, to tear the masses apart and open up the fiber. 3. Cleaned and batted, by a combined tearing and blowing action. 4. The bat is further treated in a similar manner, received on a wire gauze drum, pressed into thin sheets and delivered as a lap upon a roller. 5. Carded, to straighten the fibers and delivered in fleeces or slivers. 6. Doubled and drawn to elongate the ribbon and complete the parallelism. 7. Roved, to slightly twist the cord and wind it on bobbins. 8. Finely roved and stretched by the bobbin-and-fly frame or the stretcher mule, and delivered on bobbins. 9. Spun in the throstle which continually draws, twists and winds the yarn for warp, or in the mule which draws out and twists lengths of ab. 56 in., and then winds upon the spindle for weft. 10. Wound, doubled, and singed for the weaver.

The greater quantity of the yarn spun is woven into plain cotton cloth, while the remainder is used as warps in woolen and worsted goods or for knitting into underwear. In 1890 the number of spindles in operation in the U. S. was 14,188,103, in Great Britain 43,750,000, on the continent of Europe 24,575,000, and in India 3,270,000.

From the census of 1890 we have the following statistics of U. S. Number of looms 324,866; bales of cotton consumed 2,228,347; pounds of cotton consumed 1,193,584,641; sq. yards of woven cloth produced 3,002,761,037; total value of product $267,981,724; capital employed in the industry $354,020,843.

	Employes.	Wages.
Men	88,837	$33,797,517
Women	106,607	29,165,086
Children	23,432	3,061,935
Officers and clerks	2,709	3,464,737
	221,585	$69,489,272

The first cotton factory established in the U. S. was that of Samuel Slater at Pawtucket, R. I., 1790, and 20 years later the consumption in U. S. was ab. 10,000 bales.

The New England States lead in the manufacturing of cotton, Mass. leading, having ab. 41 per cent of all the spindles in the U. S. New England manufacturers are seriously thinking of transferring their mills to the Southern States. The latter has increased the number of its spindles threefold in the last decade. See LOOM, SPINNING and WEAVING.

Cotton Rose. See HERBA IMPIA.

Cottonwood-leaf Beetles. *Lina scripta* and *L. lapponica.* Infests also other trees. Adult is ¼ in. long, variously spotted, hibernates under rubbish. Lays bunch of yellow eggs, hatch in one week into small black larvæ that eat leaf. Collect on tree-trunk near ground and transform into adult. Entire cycle lasts a month. Use arsenites, 1 lb. to 100 gals. water.

Cotton Seed. Seed of the cotton-plant after the lint has been taken off or ginned. It is a fodder of excellent quality, but, from the hardness of the outer husk, is usually boiled before being fed. It contains nearly all the fertilizing material taken from the soil by the plant, and is rich in oils and protein substances. Two pounds of seed are produced for each pound of lint; a large part of this is still allowed to go to waste on the land where it is produced.

Cotton-Seed Hulls. The hard outer hull of the cotton seed is usually taken off before the seed is pressed to extract the oil. These hulls make a fodder of fair quality, but the greater portion of them are burned under the boilers of the oil-mills; the resulting ashes make a fertilizer exceptionally rich in potash.

Cotton-Seed Meal. Ground cake of decorticated cotton seed after the oil has been extracted by pressure. It is the richest in protein of any vegetable fodder in common use. Like all concentrated fodders, it must be fed with caution. It has a stimulating effect upon the kidneys, and is rather costive.

Cotton-Seed Oil. Vegetable oil prepared by pressing cotton seed. It consists of the glycerides of oleic, stearic and palmitic acids. and is slow drying. It makes a culinary oil of very good quality, and is largely used in making soap and in the adulteration of olive oil, lard, and similar products. A preparation of this and beef suet, called cottolene, is largely used in cooking in place of lard.

Cottonwood. Different species of trees of the genus *Populus*, natives of N. America.

Cotunnite. Lead chloride found at Mount Vesuvius.

Cotyla. Sucker-cup on the arms of the Cuttle-fish.

Cotyledons. Seed-leaves contained in the embryo of a seed. Plants whose embryo has but one cotyledon are termed monocotyledonous (see ENDOGENS); with two, dicotyledonous (see EXOGENS); more than two, polycotyledonous (see GYMNOSPERMS); when these are entirely wanting, acotyledonous.

Cotylidea. Group of Vermes, including the Cestodes and Trematodes.

Cotylophora. See PECORA.

Cotytto, or **Cotys.** Thracian divinity, like Phrygian Cybele; worshiped also in Greece, by night, with dissolute rites.

Couch, ARTHUR THOMAS QUILTER ("Q."), b. 1864. English novelist. *Dead Man's Rock*, 1887; *The Splendid Spur*, 1890.

Couch Grass. *Triticum repens.* Weedy grass of wide geographical distribution in the n. hemisphere; known also as Quitch Grass and Quack Grass.

Triticum repens.

Couching. Operation for cataract, in which the crystalline lens is forced out of position into the posterior portion of the eye, where under favorable conditions it is absorbed.

Coues, ELLIOTT, M.D., Ph.D., b. 1842. Naturalist to U. S. n. boundary commission 1873–76; prof. Columbian Univ. 1877–83; since connected with Smithsonian Institution. He has pub. much on ornithology, and is a theosophist.

Cougar. See FELIDÆ.

Cough. Sudden and violent expulsion of air from the lungs following a full inspiration. May be due to disease or irritation of the air-passages, or an irritation of some remote part, as of the ear, or stomach, or uterus.

Coulomb. Practical unit of electrical quantity; equal to the quantity of electricity that will flow in one second when the current strength is one ampère; 10^{-1} C. G. S. electromagnetic units. Named from CHARLES AUGUSTIN COULOMB, 1736–1806. French physicist and engineer, who wrote much on electricity and magnetism.

Coulomb's Law (OF TORSION). This refers to the elasticity of torsion in a rod or wire, and asserts that the reactive couple developed by torsion is proportional to the angle of torsion. The apparatus employed to establish this law was known as "Coulomb's torsion balance." A modified form of it is used to study the laws of electrical and magnetic attraction and repulsion. Coulomb's results may be condensed in the following formula,

$$\text{Reacting couple} = \frac{\pi}{2} \frac{nr^4\delta}{l};$$

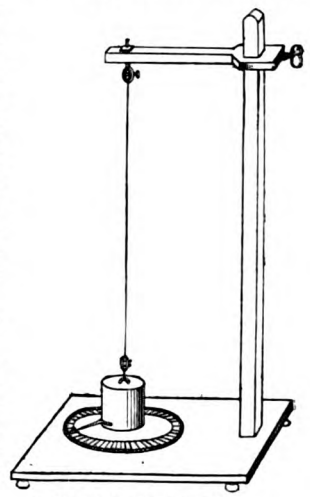
in which n is the rigidity of the material of which the wire is made, r its radius, l its length, and δ the angle of torsion.

Coulomb's Laws (OF MAGNETS). 1. Force exerted between two magnetic poles at the same distance is directly proportional to the product of the magnetic masses of these poles. 2. The force exerted between two magnetic poles of the same magnetic mass, but at different distances, is inversely proportional to the squares of the distances. Both these laws may be summarized in the expression

$$F = mm'/r^2,$$

in which F is the force acting, m and m' the magnetic masses of the poles, and r the distance separating them, all in absolute measure.

Coulomb's Torsion Balance. Apparatus for studying the laws of attraction and repulsion between two electrified masses. The forces are balanced by the torsion developed in a vertical wire, and are proportional to the angle of torsion in each case. These angles are read off on a properly arranged divided circle. The bodies carrying the electric charges are small pith balls covered with gold leaf, one fixed and the other attached to the end of a light rod suspended horizontally at the end of the torsion wire.



Coulomb's Torsion Balance.

Council. Deliberative assembly of the Church, especially of bishops. Distinguished as General, National or Plenary, Provincial or Diocesan. Among Congregationalists and Baptists, a temporary delegation of the churches, for ordination, installation, or consultation.

Council, PROVINCIAL. Bishops of a metropolitan province assembled under the archbishop.

Council Bluffs. City of Pottawattomie co., Ia., on e. bank of the Missouri, in the bottom lands opposite Omaha, Neb. It is an important railroad center. Pop., 1890, 21,474.

Council General, or **Œcumenical.** One including all the bishops of the Church, or so many as fairly represent the whole episcopate; held at Nicæa 325, Constantinople 381, Ephesus 431, Chalcedon 451, Constantinople 553 and 680, Nicæa 787, and Constantinople 869. Others regarded as such in R. C. Ch. were at Rome (Lateran) 1123, 1139, 1179, 1215, at Lyons 1245, 1274, Vienna 1311, Constance 1414–18, Basel 1431–38, Rome (5th Lateran) 1512–17, Trent 1545–63, and the Vatican 1869–70.

Council of Seville. Formed 1503 for communication with the colonies of Spain.

Council of the Indies. Formed 1511 to govern the Spanish colonies; of great power and importance during the 16th century.

Council of War. Assemblage of chief officers, as the corps commanders, summoned by the general to concert measures or submit opinions in regard to a proposed line of action.

Councils of Administration. Assembled to audit the funds of posts, canteens, and companies, to ascertain and examine the sources from and methods by which they have accrued, and to recommend expenditures therefrom. Post councils are also called to deliberate upon and recommend action upon such subjects affecting the welfare and economy of the post as commanding officers may submit to them. The post council consists of the three officers next in rank to the commanding officer; the company council of all the officers of the company present for duty.

Counselor. One who argues a case in court as distinct from one who gathers evidence, drafts and serves writs, etc. Counselor answers to the English barrister and Scotch advocate, though in the U. S. generally the work of attorney and counsel is usually performed by the same person.

Count. European title of nobility corresponding to the German Graf and English Earl whose wife is styled Countess. Under the Carlovingians the Count of the Palace was next in rank to the Maire, and later the Counts as rulers of provinces acquired almost sovereign power. Now the custom of all sons of counts also bearing the title has debased it.

Counter Approaches. Trenches run out by the besieged from their advanced works, to obtain positions for an enfilading and reverse fire of artillery and infantry against the trenches and batteries of the besiegers.

Counter Battery. Designed to dismount or silence the guns of an opposing battery by direct fire. Its crestline is parallel to that of the work to be counter-battered.

Counter Bracing. Braces connecting the chords of a bridge truss, whose office it is to carry certain stresses due to the weight of the train. They are smaller and are placed in a different direction from the main braces, which carry stresses due to both dead and moving loads. Counter-bracing was first used by S. H. Long 1836 in bridges built on the B. and O. R. R.

Counter-clockwise. Direction of rotation opposite to

clockwise; negative direction of rotation; rotation opposite to the diurnal revolution of the earth.

Counter Extension. Pulling to resist drawing on the part at an opposite point. The drawing in the knees for instance while bones of a fractured leg are drawn into place.

Counterfeit. Fraudulent similitude; ordinarily an imitation of money or securities; a misdemeanor at common law. In the U. S., the counterfeiting of coin is a statutory crime against the Federal Government, though also punishable by the States as a cheat.

Counterforts. Stone buttresses built along the back of a wall in order to strengthen it; as they are not usually visible, no regard need be paid to architectural effect in their design. When attached to the scarp wall of a fortification, their object is also to lessen the ease of trenching it, and to form a support for the casemate arches used for bombproofs; they are generally 20 feet apart.

Counter Gangway. In mining, one auxiliary to and parallel with a main gangway.

Counterglow, or GEGENSCHEIN. Faint illumination sometimes seen in that part of the firmament immediately opposite the sun. It is never visible except when the sun is some hours below the horizon.

Counter Guard. Outwork or mask, consisting of two lines of rampart parallel to the faces of the bastion or ravelin, to protect their faces from direct fire. It is separated from the latter by a narrow ditch, and its crest is placed three feet below that of the face which it protects, so as not to obstruct the fire of the face.

Counter Irritants. Agents such as mustard, pepper, turpentine, iodine, cups, blisters or caustics, which attract the blood to the points at which they are applied or irritate the nerves of the skin; are used to relieve pain, promote the absorption of fluids, or to arrest inflammation. They are usually applied over the seat of trouble or along the course of the nerve of the affected part, and act by drawing the blood to the surface and by modifying the influence of the nerves upon the nutrition of the affected part.

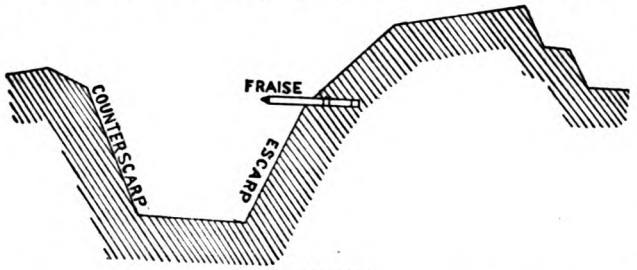
Counter Lode. Lode whose course is at right angles, or nearly so, to the course of the principal lodes in any district.

Counter Mine. System of galleries and mine chambers established under the glacis to oppose the mining operations of besiegers. They may be devised and constructed while the fortification is first established, or provision may be made for their subsequent construction at need.

Counterpoint. Combination of melodies according to the laws of harmonic progression. It is "plain" when the melodies remain throughout the piece in the same relationship, "double" when their relative position can be transposed. It originated in Europe early in 15th century.

Counterpoise Gun Carriages. Carriages for disappearing barbette seacoast guns, which, on recoil, lift up a mass of metal as a counterpoise to the gun and top carriage; on being released, the potential energy gained by the counterpoise in its lift assists in bringing the gun again into battery.

Counterscarp. The ditch of a fortification being intended as an obstacle to the enemy's progress, its walls are revetted to



Counterscarp.

prevent easy access to or from the ditch. The wall supporting the main work is the scarp, and the opposite one, the counterscarp.

Counterscarp Galleries. Masonry galleries constructed behind the counterscarp at the salients to bring a fire in the ditch over the spaces that would otherwise afford safe shelter for the enemy.

Countersign. Word given daily to such persons as are entitled to pass and repass during the night, and to the officers and sentinels of the guard. To officers commanding guards, a second word called the "parole" is given as a check upon the countersign, by which such officers as are entitled to make visits of inspection at night may be distinguished.

Countersunk Rivet. Rivet having its head in a depression reamed out around the end of the hole, so that the head does not project above the surface of the plate.

Counting Out. World-wide method among children of determining who shall be "it" in games of pursuit, such as tag, by counting around the players, a verse containing meaningless syllables being generally used. Comparison of these verses from many countries throws no light on their origin, but it appears from the counting-out rhymes of e. Asia, where the player who is "it" is called "devil" (Japan), "soldier" (China), and "watchman" (Korea), that they were once numerical formulæ, anciently used in divination in counting around the members of the clan.

Country. In military engineering, all the ground exterior to the glacis of a permanent fortification.

Country Rock. Rock traversed by a mineral vein.

County. Territorial division formerly ruled by a Count. In England counties are said to have been formed first in Alfred's reign, in Ireland not till 1562. All the States of the Union have counties except La., which has parishes.

Coup-d'eil-Militaire. Art of judging at a glance the relation of the military features of a position, so that a quick decision may direct the proper dispositions for success.

Coup-de-Main. Sudden and vigorous attack by troops for the purpose of carrying a position by assault.

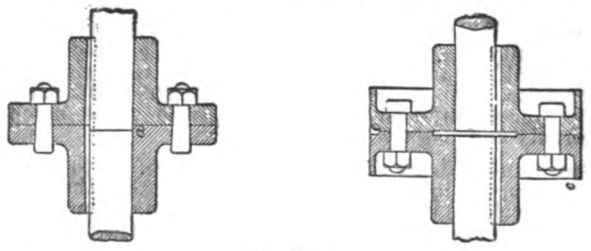
Coup d'Etat. Bold and sudden, sometimes violent, stroke of state policy; *e.g.*, the massacre of St. Bartholomew 1572, and that of Louis Napoleon Dec. 2, 1851, by which he assumed imperial powers.

Couperin. Family of French musicians, distinguished 1630–1815. The greatest of the name was François, called "le Grand," 1668–1773, famous for his *Pièces de Clavecin* and *Méthode, ou l'art de toucher le clavecin.*

Couple. Two equal parallel and opposite forces. Their resultant is zero and its point of application is at infinity. The moment of a couple is equal to the product of either force into the perpendicular distance between their lines of action; this distance is the arm of the couple. The tendency of a couple is to produce rotation only.

Couplet. Two adjoining and rhyming lines, either constituting a poem or grammatically independent of the context.

Couplings. Devices for connecting into one continuous line the short lengths of shafting in a shop or factory. Flange couplings are the most usual, each half being fitted on the end of a length of shaft, and held from turning, except with the shaft, by keys and by being a driving fit. Bolts pass through the projecting flanges and bind the two halves into a unit. Sleeve couplings are in one or two pieces, and the bolts are at right angles to the shaft instead of parallel to it. Compression couplings are the newer and approved type for lighter classes


Couplings.

of work. The different parts of the coupling are so designed that, when the bolts are tightened, conical surfaces are compressed inward with great force to become one with the shaft, and yet they can be readily taken down to add new pulleys or for other reasons. There are special couplings which may be used where the two lengths of shaft are not in the same line, yet are parallel, and again where the shafts make small angles with each other. See FLEXIBLE SHAFT and UNIVERSAL JOINT.

Coupon. That part of a bond that may be cut off and presented as a warrant for payment of interest or dividend due; also a voucher for work done or money rightfully owing.

Courage. Disposition to face danger of any kind without shrinking. Morally, an excellence rather than a duty.

Courant Ascendante, or ASCENDING CURRENT. Currents of air pushed up over mountain sides, and those ascending from hot plains, forming cumulus clouds; so called by Saussure 1785.

Courbet, GUSTAVE. 1819–1878. French genre, portrait, and landscape painter of great talent; chief instigator of the overthrow of the Vendome Column 1871, which he was compelled to replace.

Courier. Mounted messenger carrying dispatches or orders; also an upper servant used in European travel.

Courier, PAUL LOUIS. 1772–1825. French satirist and pamphleteer, noted for force and grace of style.

Courland. Province of Russia, on the Baltic; once held by the Teutonic Knights; subject to Poland 1561–1795. Pop. ab. 700,000, chiefly German Protestants.

Coursed Masonry. Masonry laid in regular courses with horizontal joints extending throughout the full length of the wall. Coursed rubble has horizontal joints at occasional intervals.

Coursing. Chasing hares with a leash of greyhounds. Formerly deer and foxes were also coursed, the sport being very popular with English royalty. Coursing clubs were formed in the 18th century and open meetings are very plentiful in England, the Waterloo Cup being the Blue Ribbon of the Kennel. In coursing two hounds are slipped together and the dog that makes most points (contributes most to the kill), is the winner. Points are scored for speed, the go-by, the turn, the wrench, the trip, and the kill.—In coal mining, conducting of the ventilating current to and through different parts of a mine, by a proper adjustment of doors, partitions, and stoppings.

Court. Place where justice is judicially administered; also the tribunal which administers it. In the U. S. two distinct systems exist within the territory of each State, one instituted by the Federal Government and one by the State. The Federal system includes the Supreme Court, holding its sessions at Washington; the Circuit Court of Appeals; the Circuit Courts, and the District Courts. The State systems generally comprise Police Courts, Courts of Justice of the Peace, County or District Courts, and Supreme Courts.

Court, ANTOINE, 1696–1760. French Protestant evangelist, founder of a theol. school at Lausanne 1729.—His son and namesake, called DE GEBELIN, 1725–1784, wrote 9 vols. on *The Primitive World*, 1773–84.

Courtesy. Abstinence in social demeanor from anything that may cause pain to others.

Courtesy Titles. Those to which the bearer has no legal right, but which are allowed by custom and courtesy. The eldest sons of English peers above the rank of baron are known by one of their fathers' secondary titles. The younger sons of dukes and marquises take the prefix Lord, and the daughters of dukes, marquises, and earls, prefix Lady by courtesy.

Court-Martial. 1. General: military court composed of officers of the army appointed either by the President, by any general officer commanding an army, a territorial division, or department, or by a colonel commanding a separate department; it may consist of any number of officers from 5 to 13. An officer can be tried only thus, and the officers composing the court shall not, as a rule, be junior to the accused in rank. 2. Regimental and Garrison courts consist each of three officers appointed by the commander of the regiment or garrison to try offenses not capital: they have no power to try commissioned officers, or to inflict a fine exceeding one month's pay, or to imprison or put to hard labor any soldier for more than one month. 3. In time of war a field-officer may be detailed in every regiment to try soldiers thereof for offenses not capital; and no soldier, serving with his regiment, shall be tried by a regimental or garrison court-martial, when a field-officer may be so detailed. In time of peace the officer next in rank to the commander at a post constitutes a summary court to try offenses that would come under a regimental or garrison court, but the accused can choose to be tried by a garrison court instead.

Military courts form no part of the U. S. judiciary; they are created by orders, have a limited existence and jurisdiction, and can try only those persons who are legally in the military service, and only for offenses recognized by the military code. In exceptional circumstances in time of war, civilians may become amenable to trial by court-martial. The judgments of military courts, when rendered upon subjects within their limited jurisdiction, are as legal and valid as those of any other tribunal. A court-martial, having entered upon a trial, has no power to terminate its own existence or function; it can be dissolved only by the convening officer or his successor in command. In awarding punishment, the sentences are in certain cases provided for in the rules and articles of war; in others they are left to the discretion of the court.

Court of Claims. Tribunal in which claims brought against the Federal Government may be settled. It was established 1855, and at first had power only to report on favorable claims to Congress, but now its awards are payable directly from the Treasury unless appealed. Money claims only are considered.

Court of Inquiry. A military court constituted to examine into the nature of any transaction of, or accusation or imputation against, any officer or soldier; it may consist of one, two, or three officers and a recorder. It may be ordered by the President, or by any commanding officer, the latter only on demand of the officer or soldier whose conduct is to be inquired into. It has the same power to summon and examine witnesses as is given to courts-martial; and unless specially ordered to do so, it gives no opinion on the merits of the case.

Court of Private Land Claims. Established to adjudicate upon claims against the U. S. regarding land within any territory gained from Mexico by treaty or otherwise. It consists of a chief and four associate justices, three of whom form a quorum, and an appeal may be carried to the Sup. Court.

Court, PRESENTATION AT. Ceremony by which various social privileges are acquired. Presentation occurs for gentlemen at the levees at St. James's Palace, and for ladies and gentlemen at the drawing-rooms at Buckingham Palace. Court-dress, or uniform, is worn, and any one of social eminence or distinction of any kind is eligible, a blemished reputation only excluding. The Lord Chamberlain has charge of the functions, and presentation entitles the individual to presentation by the various ministers at foreign courts.

Courtney, LEONARD HENRY, b. 1832. Prof. Univ. Coll., London, 1872–76; M. P. from 1876.

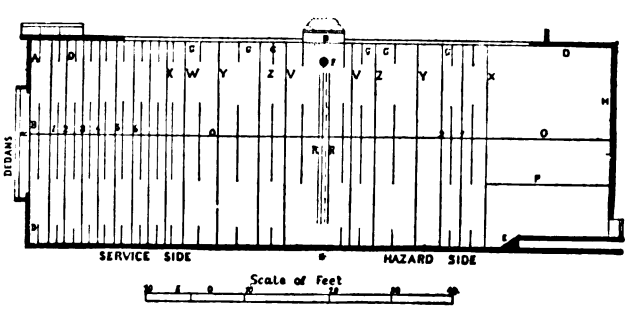
Courtois, BERNARD, 1777–1838. French chemist who in 1812 discovered iodine in the mother liquor of kelp. Was assistant to Fourcroy at the Polytechnic School in Paris. With Seguin he discovered the alkaloid of opium.

Courtois, GUSTAVE, b. 1852. French figure and portrait painter, brought into notice by *Dante and Virgil in Hell*, 1880.

Courtray, BATTLE OF. See SPURS.

Court Tennis. This is unquestionably one of the oldest of all ball games. Its origin is obscure, but it came from Italy, through France, to England in the Middle Ages; and we find it in Spain and Germany, as well as in America. The game unquestionably began by striking a ball with the hand, then the gloved hand, then a short-handled bat, and finally the long-handled racket.

Court tennis is played in a rectangular walled court over which a sloping roof, penthouse, extends on three sides to an inner wall 7 ft. high. The passage is 7 feet wide. Opposite the long penthouse is the main wall, in which a projection, called the tambour, deflects the ball across the court. In the inner wall below the penthouse there are several openings, the one at the end on the service side being called the dedans, the others the galleries. At the further end is a square opening near the main wall called the grille. The court is 96 ft. by 32. A net, 5 ft. high at the ends, 3 at the middle, divides it in half. The server stands at the dedans end of the court and knocks the ball with his racket so that it falls on the penthouse or the wall above it and bounds back within a space beyond the



Plan of Tennis Court.

A D, walls on each side of dedans; d d, gallery walls; h, grille wall; f, net post; g g, gallery post; v v, first galleries; y y, second galleries; x x, last galleries; z z, doors; o o, half-court line; r r, openings under net for ventilation and warming; 1, 2, 3, 4, 5, 6, mark chases.

net called the service court. The opponent must return the ball into the striker's court, who again returns it, taking it either upon the fly or first rebound. The player who first drives it into the net or out of bounds loses the stroke. If a player fails to return the ball before it strikes the ground twice a chase is noted against him on the marked floor. When two chases have been made, or either player reaches forty, they change ends and the one who has allowed the chase to be made then endeavors to place the second bound of the ball returned by

him nearer to the end wall than the point at which the chase was marked. His opponent returns it, and he must again attempt to do this until he succeeds or fails. A player who sends the ball into the grille, the dedans, or last division of the gallery on the hazard side, scores a stroke. If both have scored 40, one player must score two consecutive strokes to win.

Cousin, JEAN, 1520–1589. French painter and sculptor.

Cousin, VICTOR, 1792–1867. French philosopher, eclectic in method, combining the common sense of the Scottish school

Victor Cousin.

with the transcendentalism of Germany, and remarkable for his oratorical powers. *Cours de l'Histoire de la Philosophie*, 1827–41; *Du Vrai, du Beau, et du Bien*, 1854.

Cousins, SAMUEL, 1801–1887. English engraver.

Couthon, GEORGES, 1756–1794. French terrorist, guillotined with Robespierre.

Coutras. Town of s.w. France, where Henry of Navarre and the Huguenots totally defeated the Royalists under Joyeuse, Oct. 20, 1587. Pop. ab. 2,300.

Couture, THOMAS, 1815–1879. French history and genre painter. His *Romains de la Décadence*, 1847, is in the Louvre.

Couvade. Custom of certain barbarous tribes in Asia, Africa, and S. America, by which, on the birth of a child, the father takes to his bed.

Covariants. In higher algebra, such functions of the elements, both constant and variable, of a quantic that the same function of the elements of this quantic, transformed by linear substitution, will equal the original function multiplied by some power of the modulus of transformation.—In higher geometry, covariants represent other loci having a fixed relation to the given locus independent of choice of axes.

Cove. In architecture a concave molding of a quarter-circle or more in section, applied also to any convex surface, as a coved ceiling.

Covelli, NICCOLO, 1790–1829. Italian chemist and mineralogist, well known for his studies of Vesuvian phenomena. *Prodromo della Mineralogia Vesuviana*, 1825.

Covellite. CuS. Copper sulphide, known as indigo copper.

Covenant. Technically, a promise under seal; but in modern law sometimes applied to any contract. A real covenant affects real estate whether in the hands of the covenantor or his heir or grantee; a personal covenant is an obligation against maker.

Covenanters. Scottish Presbyterians who, regarding the Solemn League and Covenant of 1638 against prelacy as irrepealable law, refused to acknowledge the restored Stuart line, and were persecuted; now represented especially by the Reformed Presbyterians.

Covent Garden. Square in London, e. of St. Paul's Church; famous for its market; once the garden of the Abbot of Westminster; planned ab. 1631.

Coventry. Ancient city of England, 18 m. e.s.e. from Birmingham. Pop., 1891, 52,720.

Cover. Protection from the fire of the enemy, which may be obtained by natural or artificial means. Covered communications are trenches or passages that will permit troops to pass from one position to another without the knowledge of the enemy; boyaux or zigzags in siege operations are examples.

Coverdale, MILES, D.D., 1488–1568. English reformer;

Miles Coverdale.

translator of the Bible 1535; Bp. of Exeter 1550–53; in exile 1554–58; not restored to his see by Elizabeth.

Covered Defenses. Arrangements to shelter troops from curved or vertical fire, or from direct musketry fire. Among these are scarp and counterscarp galleries, casemates, casemated caponiers, and bomb-proofs.

Covered Flank. Flank of a bastion, covered from the enemy's fire by an adjacent bastion.

Covered Way. Open corridor or passage-way for the circulation of troops, surrounding the ditch of the body of the place and of its outworks. Its parapet is sometimes arranged for defense.

Cover Plate. Upper plate of the top chord of a bridge or girder, usually riveted to two side angles or channels so that the three form one member. Sometimes two or more plates are used.

Coversed Sine. Function of an angle = unity minus the sine.

Coverts. Feathers that overlap the bases of the quills in the bird's wing. The outermost row is composed of greater coverts, the next of median, and then the lesser.

Covington. City of Kenton co., Ky., on the Ohio, opposite Cincinnati. It has extensive manufactories of tobacco, iron, and steel. Pop., 1890, 37,351.

Cow. See CATTLE.

Cowbane. *Oxypolis rigida.* Herb of the Carrot family, growing in swamps in the e. U. S.

Cowberry. *Vaccinium vitis-idæa.* Low shrub of the Heath family, bearing small red berries used for making sauces; native of the colder portions of the n. hemisphere.

Cowboys. 1. Tory marauders in the War of Independence. 2. Herders of cattle on the Western Plains.

Cow-buntiug. See CUCULIDÆ.

Cow-catcher. Inclined triangular fender in the front of locomotives reaching close to the rails to throw obstructions off the track. Patented by Lindo in England 1840.

Cowell, EDWARD BYLES, b. 1826. Prof. Calcutta 1856, Cambridge 1867. He has tr. and edited several Sanskrit books.

Cowen, FREDERIC HYMEN, b. 1852 in Jamaica. English composer of music, pupil of J. Benedict, J. Goss, and the conservatories of Berlin and Leipsic; author of Operas, Cantatas, and Symphonies.

Cow Herb. *Saponaria vaccaria.* Smooth plant of the Pink family, native of Europe, introduced as a weed in America.

Cowley, ABRAHAM, 1618–1667. English poet and essayist. Posterity does not support the judgment of his time, which placed him among the greatest.

Cowley, HENRY RICHARD CHARLES WELLESLEY, EARL, 1804–1884. English Ambassador to France 1852–67; nephew of the Duke of Wellington; Baron 1847, Earl 1857.

Cow Parsnip. *Heracleum lanatum.* Coarse white-flowered plant of the Carrot family, native of e. N. America.

Cow Pea. *Dolichos sinensis.* Species of bean, largely grown in the South, and to a less extent in n. States, as a forage plant and for green manure. Many varieties are known, differing in the color and size of the seed and the leafiness of the plant.

Cowpens. In n.w. S. C. Here, Jan. 17, 1781, the British under Col. Tarleton were defeated by Gen. Morgan.

Cowper, WILLIAM, EARL, 1664–1723. Lord Chancellor 1705–10 and 1714–18.

Cowper, WILLIAM, 1666–1709. English anatomist, discoverer of Cowper's glands, beneath the urethra.

Cowper, WILLIAM, 1731–1800. English poet; leader in the reaction against the school of Pope. His *Task* appeared 1785, his tr. of Homer 1791, and his hymns with John Newton's

William Cowper.

1779. His Letters, pub. 1824, are full of charm. Always shy and morbidly sensitive, his mind gave way for a time in 1763, and hopelessly toward his death; but his purity and gentleness have endeared him to multitudes.

Cowper's Glands. Two small glands, sometimes single, occasionally lacking, which open into the bulbous portion of the male urethra. They secrete a viscid mucus, whose function is unknown. Sometimes become inflamed, the condition being known as Cowperitis. See COWPER, WILLIAM.

Cowpox. Vaccinia. Contagious disease of cows, probably a modified form of small-pox, originally transmitted to them from man, with a vesicular eruption, the lymph from which, when inoculated upon man, confers immunity against small-pox. See VACCINATION.

Cowry. Univalve shells of over 100 species of *Cypræa*, prized in the E. Seas for their brilliant colors and high polish. The Money Cowry, *Cypræa moneta*, is used as currency in Siam, Bengal, and many parts of Africa. Its value in India is from 2,400 to 3,200 the rupee. They are favorite ornaments with the natives, worn as chains, bracelets, etc. In the Friendly Islands the privilege of wearing the Orange Cowry is granted only to chiefs of the first rank.

Cowslip. Various species of the genus *Primula* of the Primrose family, natives of Old World, widely cultivated. Name erroneously applied in New England to *Caltha palustris*, the Marsh Marigold.

Cowslip, AMERICAN. See SHOOTING STAR.

Cowslip, VIRGINIAN. *Mertensia virginica.* Smooth, showy, purple-flowered herb of the Borage family, native of e. N. America, cultivated for ornament; known also as Lungwort.

Cow Tree. *Brosimum galactodendron.* Large forest tree of n. S. America, of the natural family *Urticaceæ*, with milky juice. In Guiana, *Tabernae montana utilis;* further s. a species of *Collophora*, both of the Dogbane family; in Brazil, *Mimusops elata* of the Star-Apple family, all with milky sap.

Cow Wheat. Species of the genus *Melampyrum*, natives of the n. hemisphere; the European species is a weed in wheat fields.

Cox, DAVID, 1793–1859. English landscape painter, eminent in water-colors.

Cox, EDWARD TRAVERS, b. 1821. Assistant in geological surveys of Ky. and Ark.; State Geologist of Indiana 1868–80; pub. 8 annual reports; Prof. Univ. Ind.

Cox, FRANCES ELIZABETH. English translator. *Hymns from the German*, 1841–64.

Cox, SIR GEORGE WILLIAM, b. 1827. English divine and author. *Poems*, 1850; *Tales of Ancient Greece*, 1868; *Mythology of the Aryan Nations*, 1870; *Comparative Mythology and Folklore*, 1881; *Lives of Greek Statesmen*, 1886; *Life of Colenso*, 1888. He was elected to the see of Natal 1891, but not consecrated.

Cox, JACOB DOLSON, LL.D., b. 1828. Gen. U. S. Vols. 1861–65; Gov. of Ohio 1866–67; U. S. Sec. Interior 1869–70; M. C. 1877–79; pres. Univ. Cincinnati 1885.

Cox, KENYON, b. 1856. American figure painter, especially strong in design from the nude.

Cox, PALMER, b. 1840. American artist of Canadian birth; author of *The Brownies* and other juvenile books.

Cox, SAMUEL, D.D., 1826–1893. English liberal theologian, Baptist pastor at Nottingham from 1863; ed. *Expositor*, 1875–84. *Salvator Mundi*, 1877; *The Larger Hope*, 1883.

Cox, SAMUEL HANSON, D.D., LL.D., 1793–1880. American divine and wit, prof. at Auburn 1834; Presbyterian pastor in Brooklyn 1837–54. *Quakerism*, 1833.

Cox, SAMUEL SULLIVAN ("SUN SET"), 1824–1889. M. C. from Ohio 1857–65, from N. Y. 1869–85; U. S. Minister to Turkey 1885–86. *Why We Laugh*, 1876.

Coxa. Basal joint of an insect's leg.

Coxalgia. Hip-joint disease.

Coxe, ARTHUR CLEVELAND, D.D., LL.D., b. 1818. Son of Dr. S. H. Cox; Bp. of Western N.Y. 1865. *Christian Ballads*, 1840; *Apollos*, 1874.

Coxe, ECKLEY BRINTON, 1839–1895. Mining engineer; writer on technical education and on engineering; pres. of American Inst. Mining Engineers 1878–80; pres. of American Soc. Mechanical Engineers 1892–94; translator of Weisbach's *Mechanics of Engineering*, 1872.

Coxe, TENCH, 1755–1824. American economist.

Coxe, WILLIAM, 1747–1828. English historian; Archdeacon of Wilts 1805. Besides a *History of the House of Austria*, 1807, he wrote memoirs of Walpole, 1798–1802, of Marlborough, 1818–19, of Stillingfleet, 1811, and of the Bourbon Kings of Spain, 1813.

Coxocerite. Basal joint of the antennæ of Lobsters.

Coxopodite. Basal joint of the legs and other appendages of the lobster-like animals.

Coxswain. Steersman of a boat.

Coxwell, HENRY TRACEY, b. 1819. English aeronaut.

Coyote. Small variety of wolf of western prairies of U. S. and Mexico. Larger than common fox, yellowish-gray on the back, white below. It does not attack men or larger animals except when much starved and the animals are sick or infirm. See WOLF.

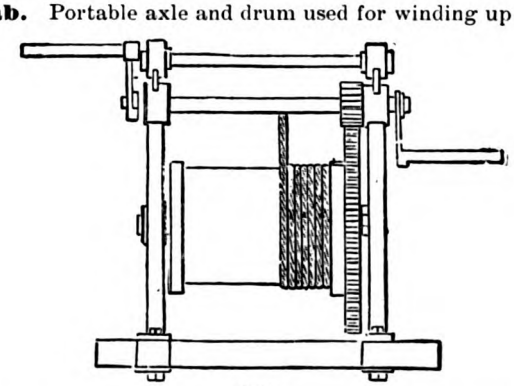
Coyoting. Mining in small excavations of irregular form, suggestive of the burrowing of animals; Pacific Coast term.

Coypel, NOEL, 1628–1707. French painter.—His sons, ANTHONY, 1661–1721, and NOEL NICHOLAS, 1692–1735, and his grandson, CHARLES ANTHONY, 1694–1752, were also noted artists.

Coypu. *Myopotamus coypu.* S. American rodent of semi-aquatic habits, hunted for its fur, which is brownish-yellow in color. It is 2 ft. long, with webbed hind feet and scaly tail, and is found on both sides of the Andes.

Cozzens, FREDERICK SWARTWOUT, 1818–1869. American humorist. *Sparrowgrass Papers*, 1856; *Acadia*, 1858.

Crab. Portable axle and drum used for winding up a rope



Crab.

in order to lift weights, the axle being turned by a crank or by levers; used in the construction of bridges and buildings.

Crab Apple, AMERICAN. *Pyrus coronaria* and *P. angustifolia.* Small trees of the natural family *Rosaceæ*, natives of e. U. S.

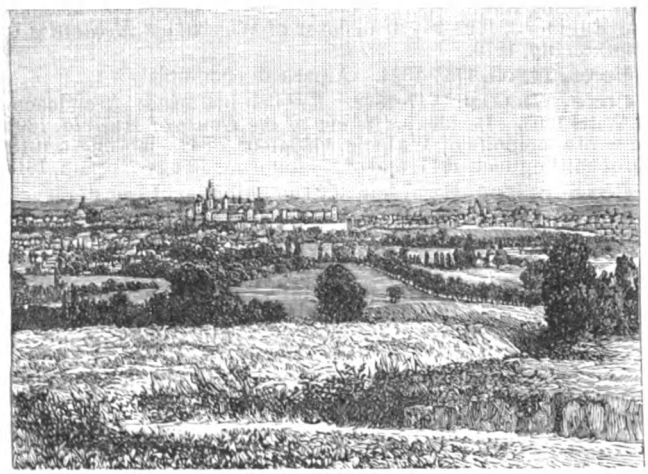
Crabbe, GEORGE, 1754–1832. English poet, who in homely but powerful style described the tragedy of life among the lowly. He was patronized by Burke, and ordained 1782. *The Library*, 1781; *The Village*, 1783. His chief works were much later: *The Parish Register*, 1807; *The Borough*, 1810; *Tales*, 1812; and, *Tales of the Hall*, 1819. Byron called him "Nature's sternest painter, yet the best."

Crab Grass. *Eleusine indica*, known as Yard Grass, a native of India; also *Panicum sanguinale*, known as Finger Grass, native of Europe. Both introduced as weeds into N. America, and extremely abundant.

Crabs. See BRACHYURA. The following tribes are distinguished: *Notopoda*, with the last feet raised toward the back and the female generative orifice on the basal joint of the third pair of legs, as in *Porcellana*. *Oxystomata*, with circular shell and pointed mouth area, the male opening on the basal joint of the fifth pair of legs, as in the *Leucosidæ*. *Oxyrhyncha* or *Majacea*, having a pointed rostrum and genital openings as in the last. *Cyclometopa* (*Cancroidea* or *Arcuata*), with a cephalothoracic shield, wide in front, narrow behind, and the male opening on the coxal joint of last pair of legs. *Catometopa* (*Grapsoidea* or *Quadrilatera*), with the male genital opening situated on the sternum, as in *Gecarcinus*.

Crabs' Eyes. Two small, calcareous, lenticular plates formed in spring, beneath the chitinous lining of the stomach in the Crayfish; lost (absorbed) during the moulting (ecdysis); used to put under the eyelids, to remove foreign objects.

Cracow. City of Galicia, Austria, on left bank of the Vistula, at mouth of the Rudowa. It was founded ab. 700; taken by Bohemians 1039, by Mongols 1241; capital of Poland



Cracow.

1320–1609; taken by Swedes 1655 and 1702, by Russians 1768; given to Austria 1795, and again 1846, after being a republic from 1815. Pop., 1890, 75,593.

Craddock, CHARLES EGBERT. See MURFREE, MARY N.

Cradle. Box on rockers used in washing gold-bearing sands

Cradock, MATTHEW, d. 1640. London merchant, first gov. of the Mass. Company; M. P. 1640.

Craft Guilds. Mediæval associations of handicraftsmen; offshoot of the merchant guilds, at first including all members of their particular trade, afterward exclusive.

Craftsman. Periodical begun Dec. 5, 1725, extending to 14 vols., and noted for the attacks by Lord Bolingbroke, Wyndham, and Pulteney, upon Sir R. Walpole.

Craie de Briancon. French chalk; compact talc.

Craig, JOHN, 1512–1600. Scottish reformer; coadjutor to Knox 1563.

Craig, THOMAS, 1538–1608. Scottish lawyer and poet, knighted 1603. *Jus Feudale*, 1608.

Craigie, MRS. PEARL (RICHARDS), b. 1867. English novelist of American birth, writing as "John Oliver Hobbes." *A Bundle of Life*, 1893; *The Gods*, etc., 1894.

Craik, MRS. DINAH MARIA (MULOCK), 1826–1887. English novelist and poet, pensioned 1864, m. 1865; best known by *John Halifax, Gentleman*, 1857. *The Ogilvies*, 1849; *A Life for a Life*, 1866.

Craik, GEORGE LILLIE, 1799–1866. Scottish author; prof. at Belfast from 1849. *Pursuit of Knowledge*, 1831; *History of British Commerce*, 1844; *Literature and Learning in England*, 6 vols., 1844–45; *Spenser*, 1845; *Bacon*, 1846–47; *Romance of the Peerage*, 1848–49; *English of Shakespeare*, 1857.

Crambessidæ. Family of *Rhizostomæ*, including *Medusæ*, having a single central sub-genital space, with eight mouth-arms; and, into the space included above, both dorsal and ventral frilled funnels open.

Cramer, GABRIEL, 1704–1750. Prof. Math. at Geneva. *Algebraic Curves*, 1750.

Cramer, JOHANN ANDREAS, 1710–1777. German mineralogist and metallurgist; author of several works of great value for their time.

Cramer, JOHANN BAPTIST, 1771–1858. German-English pianist and publisher; author of *Studies*.

Cramer, MICHAEL JOHN, D.D., b. 1835. U. S. Minister to Denmark 1870–81, and to Switzerland 1881–85; prof. Boston Univ. 1885–87.

Cramp. Painful contraction of a muscle or set of muscles; less correctly, severe colic.

Crampton's Gap. In Frederick co., Md.; scene of a defeat of Confederates under Gen. Cobb by Federals under Gen. Franklin, Sept. 14, 1862.

Cranach, LUCAS, 1472–1553. German painter and engraver; friend of Luther, of whom he made several portraits; court painter to Frederick the Wise of Saxony and two following electors. He ranks next to Dürer and Holbein, but far below them.—His son, LUCAS, 1515–1586, headed the Saxon school. Both were burgomasters of Wittenberg.

Cranberry. *Schollera palustris.* Native of colder parts of

Cranberry (*Schollera palustris*): *a*, flower; *b*, fruit.

plants of the natural family *Ericaceæ*, valued for their fruit. the n. hemisphere; also *S. macrocarpa*, of e. N. America; small

Cranberry Insects. Katydids, leaf hoppers, a scale-insect, etc., live off the Cranberry, but the following are of serious importance: 1. *Rhopobota vacciniana*, a moth whose eggs hatch into slender green black-headed larvæ that kill the leaves while spinning them into a cocoon. In two or three days a bog can in this way be changed from green to brown. The flowers also are killed. Two broods yearly, the first from eggs that have wintered over. 2. *Teras vacciniivorana*, a moth orange in summer broods, gray in autumn. The autumn moths winter under rubbish and lay eggs in the spring that hatch in May. By June the larvæ are transformed into orange moths. The larvæ of the winter moths are reddish, the others are green with yellow heads. Pyrethrum, tobacco decoction, arsenites, kerosene, may be used. 3. *Acrobasis vacinii* is a reddish-green larva of a gray moth which lays eggs on the fruit. The young bore into the berry and travel into new berries to mature by September. Spray with arsenites at fall of flowers. 4. *Cecidomys vacinii*, the "tip-worm," eats out the terminal bud and stunts the vines.

Cranberry Tree. *Viburnum opulus.* Large shrub of natural family *Caprifoliaceæ*, native of n. parts of n. hemisphere, bearing showy clusters of white flowers and acid red fruit, substituted for cranberries.

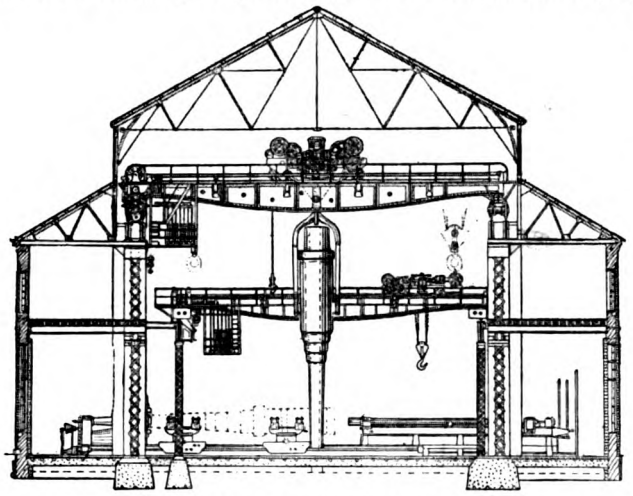
Cranbrook, GATHORNE-HARDY, EARL, b. 1814. M.P. 1856, Viscount 1878, Earl 1892; member of several Cabinets.

Cranch, WILLIAM, LL.D., 1769–1855. Chief Justice of U. S. Circuit Ct. for Dist. of Columbia from 1805. *Reports of the U. S. Supreme Court*, 9 vols., 1801–15; *Reports of U. S. Circuit Court*, 6 vols., 1852–53.—His son, CHRISTOPHER PEARSE, 1813–1892, was a poet and artist. Tr. *Æneid*, 1872.

Crane. See PALUDICOLÆ.

Crane. Apparatus for lifting a weight and moving it horizontally. In rotary cranes, the load is revolved around a fixed axis or column; in rectilinear cranes, the load is moved in straight lines. The types of rotary cranes are: 1. Derrick, or quarry cranes, in which a central mast is steadied at the top by guy-ropes, and a boom pivoted at the bottom can be raised and lowered so as to vary the radius of the swing. 2. Jib cranes, in which an upright mast steadied at the top by guy ropes or by rigid bracing has a horizontal jib, on which a buggy runs out and in; if there is no buggy nor horizontal adjustment of the load, this becomes a swing crane. 3. Pillar cranes, in which a central column steadied by a heavy foundation has a boom revolving round it, which carries the load; this is a frequent type for wharf and railroad wrecking purposes. When the central pillar is carried up in a building to support an upper

floor, this becomes a column crane, and reverts usually to the jib type. 4. Locomobile cranes, of any of the foregoing types, mounted upon a platform on wheels, which travel usually upon rails; these may be self-propelling in large sizes. 5. Rotary bridge cranes, in which a horizontal bridge is steadied at one end by a pivot, at the other by a frame or trestle-bent, which is carried upon wheels running on a circular track; the buggy on the bridge hoists the load, and can be made to move radially along the bridge.—Rectilinear cranes are of two classes: 1. Bridge cranes, in which a buggy hoists and moves the load across a fixed bridge or girder supported overhead; this may by



110-ton and 40-ton Traveling Cranes in Position.

inversion be made into a tram crane, in which the short bridge carrying the fixed buggy moves longitudinally over a pair of rails, without transverse adjustment. 2. Traveling cranes, in which over a rectangular space a bridge is supported by rails at the upper part of the side walls and may be moved longitudinally upon them; on this bridge is a buggy or crab, which may have transverse motion on the bridge. Gantries are traveling cranes in which the rails for the lengthwise motion are on the ground, and the overhead bridge is supported by a frame or trestle-bent resting upon wheels on these rails. Cranes may be driven by hand or animal power, by steam, by hydraulic pressure, or by gearing from the transmissive machinery of the works. A floating derrick crane to lift 100 tons is used in Mersey Harbor, England. Traveling cranes for transporting weights in shops are often operated electrically; the largest in the world, shown in the figure, is probably the 123-ton machine built in 1890 for the U. S. Navy. See DERRICK and SHEARS.

Crane, THOMAS FREDERICK, b. 1844. Prof. Cornell Univ. since 1868; writer on folk-lore and Romance languages.

Crane, WALTER, b. 1845. English painter and illustrator.

Crane, WILLIAM H., b. 1845. American actor.

Cranesbill. Many species of the genus *Geranium*, of wide geographical distribution. The fruit is prolonged into a beak-like structure. Garden Geraniums belong to the genus *Pelargonium*.

Craney Island. Below Norfolk, Va.; attacked by the British June 22, 1813.

Cranial Flexure. Ventral bending of the head of Vertebrate embryos around the end of the notochord; due to the precocious development of the dorsal walls of the brain.

Cranial Nerves. Twelve pairs of nerves which originate within the skull and are distributed to the head, organs of sight, sound, speech, taste and smell, and heart and stomach.

Craniometry. Measurement of the cranium, in fact entire skull. Cranial capacity is obtained by filling the brain-case with mustard seed; normally varies from 60 to 110 cubic in. Andaman Islanders and Australians are microcephalic (below 84), English and Eskimo are megacephalic (above 88), Chinese are mesocephalic. The cerebral index is ratio of breadth to length of cavity. Cephalic index is similar ratio on outside of cranium; varies from 66 to 88. Northern Mongolians are brachycephalic (above 80), Australians are dolichocephalic (below 75), English and Chinese are mesaticephalic. Vertical index is height to length, varying from 71 in English to 77 in Andaman Islanders. Gnathic index (alveolar index), indicates the prominence of the jaws, ratio of distance from foramen magnum to root of nose compared with distance to alveolar point (base of upper middle incisors). English are orthognathous (below 98), Australians are prognathous (above 103). Eskimos are mesognathous. Nasal index, ratio of width to height of nose at base; English and Eskimos are leptorhine (below 48), Australians platyrhine (above 53), Chinese are mesorhine. Orbital index, height to breadth of eye socket; Andaman Islanders are megaseme (above 89), Australians, microseme (below 84), English are mesoseme. A high, long, boat-shaped cranium (scaphocephaly) is due to premature closure and obliteration of sagittal suture. No skull is entirely symmetrical; slight plagiocephaly usually exists normally. A great number of angles are recognized in Craniometry. Facial angle of Cloquet has apex at alveolar point, base included between ear opening and ophryon (base of forehead). Camper and Legond each use different points to measure angle of this name.

Craniota. Phylum of animals, including forms possessing a skull with a bony or cartilaginous case surrounding the brain. All the Vertebrates except *Amphioxus* belong here, and are divided into three provinces, *Ichthyopsida* (Fishes and Amphibia), *Sauropsida* (Reptiles and Birds), and *Mammalia*.

Cranium. Portion of the skull containing the brain.

Crank. A person who in season and out of season supports some pet theory, and runs counter to generally accepted notions in such a way as to become a monomanic.

Cranmer, THOMAS, D.D., 1489–1556. Abp. of Canterbury 1532; chief author of the Prayer Book, and leader of the English Reformation. More a courtier than a hero, his prudence escaped many dangers under Henry VIII., and rendered inestimable services to liberty. He was a regent under Edward VI. Long imprisoned under Mary, he recanted through terror of the stake, but died nobly, promoting his cause as efficiently by his end as through his life. He was burned at the stake.

Crannog. Artificial island, made of brushwood, earth, and gravel, held together by piles and supporting huts; a kind of lake-dwelling of the prehistoric Scotch and Irish.

Crannon. In Thessaly; scene of a defeat of confederated Greeks by the Macedonians under Antipater, 322 B.C.

Crantz, HEINRICH JOHANN NEPOMUK VON, 1722–1799. Prof. Botany Univ. Vienna. *Materia medica*, 1762–65; *Stirpes Austriacæ*, 1762–67; *Classis Umbelliferæ emendata*, 1769; *Classis Cruciformium emendata*, 1769.

Cranworth, ROBERT MONSEY ROLFE, BARON, 1790–1868. M. P. 1832; Lord Chancellor 1852–58 and 1865–66.

Craonne. In n. France; scene of Ney's defeat of the Allies under Blücher, March 7, 1814.

Crape. Transparent silk fabric, curiously twisted and roughened in the weaving. Japanese and Chinese crapes are white and colored with ornamental patterns, but European crape is black and white and used extensively for mourning.

Crashaw, RICHARD, ab. 1613–1649. English lyric poet. He joined the R. C. Ch. in France 1646. *Steps to the Temple*, 1646.

Craspeda. Long convoluted cords armed with nettle cells, attached to the free edges of mesenteries of the sea anemone and various medusæ (mesenterial filaments).

Craspedota. Hydromedusæ.

Crassilinguia. Sub-order of Lizards, with thick, short, fleshy tongue, which cannot be protruded. The toes are directed forward; the tympanic membrane is exposed. They live in the tropical parts of both hemispheres. The group comprises the Geckos and Iguanas. The former are small plumpish lizards, with viscous lobes on the toes, enabling them to run on walls. They have pleurodont teeth, and are nocturnal in habit. The Iguanas have long legs and laterally flattened bodies, with triangular heads, a helmet-like sac, and dorsal crest. They can change color like the chameleons. The Old World forms are acrodont in dentition; the New World forms are parallel types, but pleurodont. *Draco volans*, the Flying Dragon, is an example. It has its anterior ribs long and covered by skin in such a way as

Flying Dragon.

to form lateral sail-like expansions, allowing flying leaps to be made.

Crassulaceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising 15 genera and ab. 485 species, growing in tropical regions and especially in the temperate zones and warmer parts of Europe, w. Asia, s. Africa, and N. America; commonly called the Orpine family.

Crassus, Marcus Licinius, d. 53 B.C. Prætor of Rome and conqueror of Spartacus 71 B.C.; Consul 70 and 55; Triumvir with Cæsar and Pompey 60; Gov. of Syria 55; defeated by Parthians in the desert near Carrhæ 53; noted for wealth and greed.

Crater. Cup or opening at the top of a volcano, through which matter is thrown forth. A crater may sometimes exist where there is no mountain, but the erupted material will in time produce one. This is probably the origin of Mount Etna.

Crater. Hole or depression produced by the explosion of a mine-charge. Theoretically, its form is assumed to be the frustrum of a cone. A maximum crater is one for which the volume is a maximum for the same charge in the same material. The crater radius is the radius of the upper surface of the crater. The radius of explosion is the distance from the seat of the charge to the circumference of the upper circle.

Crater, Electric. Small cavity formed at the end of the positive carbon in an electric arc lamp. Being the hottest part of the carbon, it is the point emitting the maximum amount of light.

Crateriform. Saucer-shaped corolla of certain plants.

Crates. Athenian comic poet of 5th century B.C.

Crates. Theban cynic, ab. 320 B.C.

Crates. Philologist and critic of Mallus, Cilicia; librarian at Pergamos; teacher at Rome ab. 167 B.C.

Cratinus, ab. 519–422 B.C. Greek poet, originator of political comedy.

Cratippus, 1st century B.C. Peripatetic philosopher at Athens.

Crau Wind. Cold, dry, strong wind on the arid plains of s.e. France, known as the Crau district; local name for the Mistral.

Craven, Mme. Augustus (de la Ferronays), 1809–1891. French novelist. *A Sister's Story; Fleurange.*

Crawford, Francis Marion, b. 1854 in Italy. American novelist, son of Thomas; familiar with many lands, but resident chiefly in Italy, and especially happy in depicting Roman society and character. *Mr. Isaacs*, 1882; *Doctor Claudius*, 1883; *A Roman Singer*, 1884; *Zoroaster*, 1885; *Saracinesca*, 1887; *Greifenstein*, 1889; *A Cigarette Maker's Romance*, 1890; *Khaled*, 1891; *Pietro Ghisleri*, 1893; *Katharine Lauderdale*, 1894; *The Ralstons*, 1895; *Casa Braccio*, 1895.

Crawford, Thomas, 1814–1857. American sculptor, pupil of Thorwaldsen. *Orpheus Seeking Eurydice; Indian Chief;* in pediment of the Capitol at Washington, group representing *Growth of American Civilization;* on the Capitol dome, statue of *Liberty;* on the bronze doors of the U. S. Senate Chamber, reliefs of revolutionary and republican scenes.

Crawford, William Harris, 1772–1834. U. S. Senator from Ga. 1807–13; Minister to France 1813; Sec. Treasury 1816–25; presidential candidate 1824; Circuit Judge of Ga. from 1825.

Crawford and Balcarres, Alexander William Crawford Lindsay, Earl of, 1812–1880. Scottish author. *Christian Art*, 1847.

Crayer, Caspar de, 1582–1669. Flemish painter.

Crayfish, or Crawfish. See Astacus.

Crayons. Soft and friable sticks of colored mineral substances used in the arts for drawing. They consist of fine pipe- or china-clay, mixed with pigments.

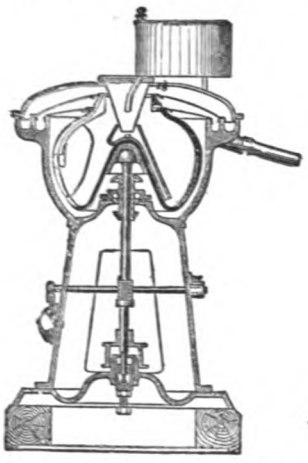
Cream. That part of milk into which a large percentage of its fat has been gathered. It is composed of the same constituents as milk, but they are not in the same or any constant relative proportion. It is separated from milk either by the force of gravity or by centrifugal force.

Creamer. Machine for separating cream from milk by the force of gravity. It consists simply of narrow, deep pails into which the milk is placed as nearly as possible at the temperature at which it is drawn from the cow, and then immersed in cold water, so that the temperature may be reduced to 45° F. as rapidly as possible.

Creamery. Place where cream or milk is gathered to be made into butter. The establishment of co-operative creameries, where the milk of a large number of producers is worked up together by skilled workmen, has led not only to the great improvement of the product, but to a great extension of the industry in all parts of the U. S., particularly the central West. See Dairy.

Cream of Tartar. $KHC_4H_4O_6$. Potassium hydrogen tartrate, or acid potassium tartrate. Present in fruit juices, particularly in grape juice, from which it separates during the alcoholic fermentation, on account of its insolubility in alcohol, in the form of argols. It can be prepared from argols by crystallization, but better by the neutralization of tartaric acid. It is a white solid, soluble with difficulty in cold water, and is used for domestic purposes, to decompose carbonates, and also in textile coloring, but chiefly in the manufacture of baking powders. The argols are the source for tartaric acid.

Cream Separator. Machine for the separation of cream from milk by centrifugal force. It consists essentially of a hollow drum capable of being very rapidly revolved. Into this drum, running at great speed, the milk is allowed to flow from a spigot. The heavier part is thrown to the outside, and the



Alexandra Cream Separator.

Centrifugal Separator, moved by direct application of steam.

lighter cream collects in the center, where both continually escape by means of properly arranged outlets. These outlets and the inflow being carefully regulated, the operation is continuous, and any given proportion desired may be taken off as cream or as skim-milk.

Creasote. See Creosote.

Creasy, Sir Edward Shepherd, 1812–1878. Prof. Univ. Coll., London, 1840; Chief-Justice of Ceylon 1860. *British Constitution*, 1848–56; *Fifteen Decisive Battles*, 1852; *Ottoman Turks*, 1856; *Hist. England*, 1869–70; *Imperial and Colonial Constitutions*, 1872.

Creatine. $C_4H_9N_3O_2$. Found in the muscular flesh of vertebrates. Discovered by Chevreul 1835. Studied by Liebig 1847. Constituent of meat-soups and extracts, and imparts an appetizing taste and stimulating action to the heart and muscular centers. Soluble in 70 parts of water, but insoluble in alcohol.

Creatinine. $C_4H_7N_3O$. Found in human urine (ab. 5 per cent) and in the flesh of some fish. Made by the action of a dehydrating agent upon creatine. Powerful organic base.

Creation. Act of bringing something into existence, as distinguished from merely manufacturing it out of materials already existing.

Crébillon, Prosper Jolyot de, 1674–1762. French dramatist, Academician 1731. *Idoménée*, 1705; *Atrée*, 1707; *Rhadamiste*, 1711; *Catilina*, 1749.—His son, Claude Prosper, 1707–1777, was a novelist of the loose school.

Crèche. Nursery where children of working-women are cared for during the day.

Crécy, or **Cressy.** Village of n. France; scene of a great victory gained by Edward III. of England and his son Edward the Black Prince, with 40,000 men, over 100,000 French, who lost 1,200 knights and 30,000 footmen.

Credence Table. Shelf to left of altar, on which the elements are placed before consecration in the Eucharist.

Credi, Lorenzo di, 1459–1537. Florentine painter, scholar of Verocchio, and much influenced by Da Vinci; an artist of worth, but not ranking with the leaders of his time; best represented in Florence.

Credit. Confidence in a person's ability and integrity in business relations, with the resulting opportunity to command the use of existing wealth belonging to another.

Credit, Letter of. Document calling on certain specified

person or persons to pay to the person presenting the letter any amount up to a certain limit, drawing on the signer of the letter for that amount. It is used as a common facility for travelers.

Credit Foncier. Form of bank for the loan of money on security of the land belonging to all the members of the association, and in which the loan is repaid in a series of periodical installments.

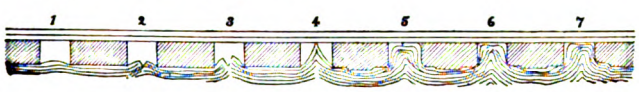
Credit Mobilier. Association designed to promote industrial enterprises, combining the functions of a construction and a banking company, as in France 1852. Bonds or other obligations are often issued, and advances are made to canals or other enterprises. The Pa. Fiscal Agency, chartered 1859, constructed the Union Pacific R.R. Many members of Congress were bribed 1867–68 by presents of its stock to vote for legislation desired by the railroad. In 1872 the Speaker demanded a committee of investigation, which made a report Feb. 1873, recommending the expulsion of one of its members for selling shares below their value to others "with intention to influence the votes of such members," and of another for receiving such shares through his son-in-law, who had been the manager of the U. P. interests in Congress. The House condemned these actions, but did not expel.

Credo. In music, third large division of the Mass, so called from the words with which it begins, *Credo in unum Deum*, the text being the Nicene Creed. Composers usually treat it in four divisions, *Credo*, *Incarnatus*, *Crucifixus*, and *Resurrexit*.

Creed. Confession of faith or statement of beliefs. Those of general Christian acceptance are the Apostles' and the Nicene; the Athanasian is retained in the English Prayer Book, but not in the American. Others have been framed by various communions.

Creeks. Indians originally of Georgia, Alabama and Florida, including confederated tribes of Seminoles, Natchez, Muskogees, and others. The Creeks were the most civilized, numbered 15,000; were mound builders. In 1836 sold their lands to Government and removed to Reservation in Indian Ter. between Cherokees and Choctaws. Pop., 1890, 14,800. Muskogees furnished the greater proportion.

Creep. Rising of a yielding floor in a coal mine, due to the settling of the overlying strata.



1. First stage of active creep. 2. Second, do. 3. Third, do. 4. Fourth, do. 5. The metal ridge closed, and the creep beginning to settle. 6 and 7. The creep settled, the metal ridges being closely compressed, and supporting the roof.

Creepers. Birds of families *Certhiidæ* and *Cœrebidæ*. The latter are the honey creepers, resemble humming birds in size, brilliant coloration, and have long curved bills for penetrating flowers; but they feed on insects, have short wings and hold on with their feet while feeding. The true Creepers are represented in N. America by an e. and three w. species. Are small birds with woodpecker-like tails.

Creeping of Rails. Longitudinal motion of a line of railroad rails in the direction of the traffic. It occurs particularly on bridges. On the St. Louis arch bridge this creeping amounts to nearly a foot per day, and no fastenings have been found of sufficient strength to resist it. The remedy is to support the rail near the middle instead of on the base.

Crees. Algonquin Indians living between Hudson's Bay and Rocky Mts., and southward, also eastward, to Labrador. They are industrious, friendly, brave, and can read and write their own language. Some of the Medicine men practiced divination by table rockings and tappings long before white "spiritualists" of U. S. originated.

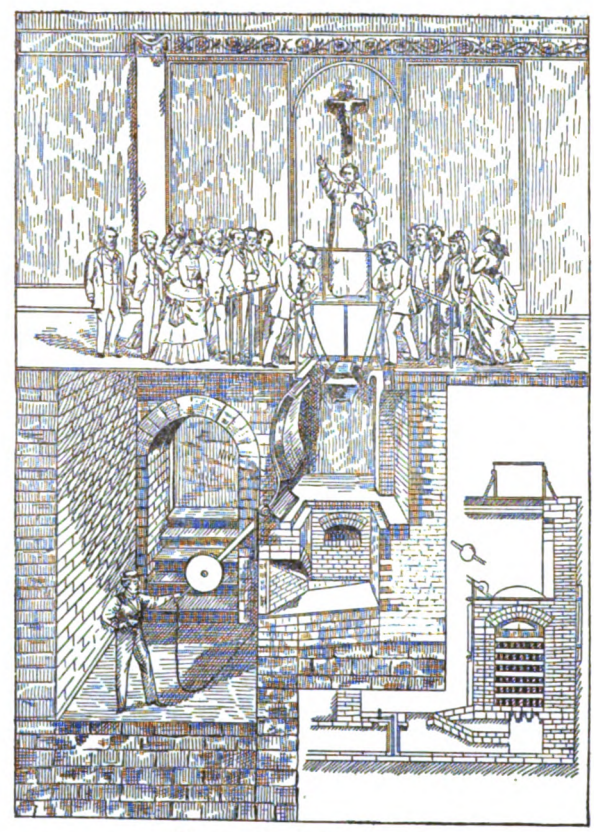
Crefeld. City of Prussia 13 m. n.w. of Dusseldorf. It has considerable manufactures of silk. Here Prince Ferdinand of Brunswick defeated the French under Count Clermont, June 23, 1758. Pop., 1890, 105,376.

Creighton, Mandell, LL.D., D.C.L., b. 1843. Prof. Univ. Cambridge 1884; Bp. of Peterborough 1891; ed. *Historical Review*, 1886. *The Papacy during the Reformation*, 4 vols, 1882–87; vol. 5, 1894.

Crelle, August Leopold, 1780–1855. German mathematician; ed. *Journal of Mathematics*, 1826–51. *Analytic Functions*, 1826; *Geometry*, 1827.

Cremaillere Line. Indented line of earthworks, consisting of alternate long and short branches meeting at an angle of ab. 90°. The short branches are made just long enough to flank the long, which take the general direction of the line.

Cremation. Usage of burning the dead, common to the ancient Scandinavians, Celtæ, Sarmatians, Scythians, Thracians, Phrygians, and the later Greeks and Romans till ab. 400. It is still general throughout s. and e. Asia and has lately been re-introduced in the West as a sanitary reform. Italy took the lead in the movement ab. 1866, crematoria being established at Padua, Milan, Lodi, Cremona, Brescia, Rome, and Varese. By Dec. 31, 1886, 788 bodies had been burned. The Cremation Society of England was started 1874, and similar societies exist in



Siemens' Apparatus (German).

Denmark, Holland, Sweden, Norway, and the U. S. Buffalo, Washington, Lancaster, Philadelphia, Fresh Pond, L. I., Detroit, St. Louis, and Los Angeles all have crematoria, as have also Père la Chaise, Paris, and Gotha, Germany. The latter, opened 1887, cremated 600 bodies in 15 mos. On the whole, the practice gains ground very slowly.

Cremation of Garbage. The first furnace for this purpose built in the U. S. was on Governor's Island, N. Y., 1885; it consisted of two parts, one for drying, the other for burning. Since 1885 a dozen or more plants have been built, mainly at Chicago, Des Moines, Milwaukee, Pittsburg, Detroit, and Buffalo. At the World's Fair in Chicago, 1893, the sewage was purified and the residue burned.

Cremer, August Hermann, D.D., b. 1834. Prof. Greifswald 1870. *Lexicon of N. T. Greek*, tr. 1886.

Cremieux, Isaac Adolphe, 1796–1880. French Jew, active in public affairs 1842–50 and from 1870; founder and pres. Israelite Alliance.

Cremocarp. Peculiar fruit of the Carrot family, consisting of two carpels, united along their inner faces, but separating at maturity, each then called a Mericarp.

Cremona. Ancient town of Lombardy, on the Po; for two centuries, 1550–1750, home of the greatest of violin makers, the Amati, Stradivarius, and Guarnerius families (q.v.), Bergonzi, Guadagnini, Ruggieri, and others. Here the Austrians defeated the French, 1799. Pop. ab. 33,000.

Crenate. Margins of leaves and other structures which are scalloped or have the teeth much rounded; when the teeth are very small, Crenulate.

Crenaux. Openings or loopholes made in the walls of a fortified place for musketry fire. The smaller dimensions of the opening are on the outside of the wall, to lessen the chances of stray shot finding their way through the loophole.

Crenelle. Sunken part of a battlement or parapet, originally introduced for defense in castles, but afterward applied

to decorate civil and ecclesiastical buildings. The wall in which it appears is said to be crenellated.

Crenic Acid. Organic acid occurring in vegetable mould and soils associated with apocrenic acid; formed by the decomposition of vegetable matter.

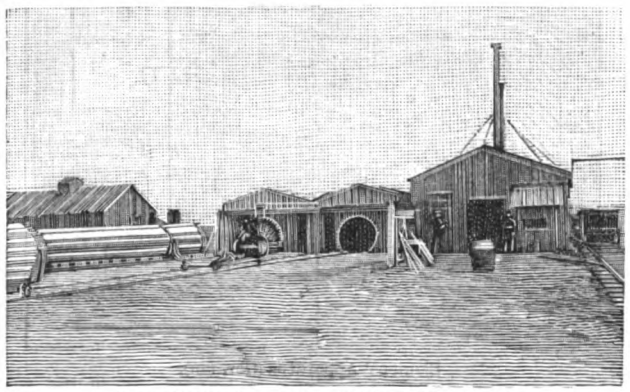
Creodonta. Sub-order of *Bunotheria*, including flesh-eating, Eocene Mammals, with small cerebral development, the corpora quadrigemina being uncovered. The glenoid articulation of the mandible is transverse, as in *Carnivora*, which order is also approximated in the sectorial character of the molars, the well-developed canines, and normal incisors. They may be considered ancestral to modern *Carnivora*, but present close affinities in various directions with the *Marsupialia*, *Insectivora*, and *Lemuridæ*.

Creole. An inhabitant of the warmer parts of N. or S. America, of foreign descent, usually of pure blood, to distinguish him from the aborigines. In Alaska applied to half-breed Indians or Negroes.

Creosote. Mixture of phenols, formed by the dry distillation of wood, and a main component of wood tar; also, mixture of phenols obtained from coal tar. It has antiseptic properties.

Creosote Bush. *Covillea mexicana.* Ill-smelling shrub of the natural family *Zygophyllaceæ*, native of desert regions of the s.w. U. S. and n. Mexico.

Creosoting. Impregnation of timber with dead oil in order to prevent decay and protect it from sea worms. The timber is placed in a large tank, from which the air is at first partially exhausted, in order to dry out the sap; the creosote



Lehigh Valley Creosoting Works, Amboy, N. J.

oil is then pumped in under a pressure of 120 lbs. per sq. in., and impregnates the timber to the depth of an inch or two. Creosoting costs from $6 to $8 per 1,000 ft., board measure. It is mostly used for piles which are to be placed in salt or brackish water, where sea worms abound.

Crepuscular. Flying or roving at dusk or at dawn.

Crescendo. Increase of sound, or change from piano to forte.

Crescent, Order of the. 1. Instituted by René. Duke of Anjou, 1464. 2. Decoration bestowed by Sultan Selim III. after the battle of Aboukir 1799 on Nelson and others.

Crescent Truss. Roof truss having its chords so shaped as to give the truss the outline of a crescent; frequently used for the roofs of railway stations.

Cresilas. Greek sculptor of 5th century B.C. The *Amazon* of the Capitol Museum has been considered a copy of one of his works.

Cresols. $CH_3.C_6H_4.OH$. Phenols of toluene. Three forms, ortho-, meta-, and para-cresol are present in coal tar and wood tar. They are prepared from the creosote oils obtained in distilling coal tar, and used in the manufacture of artificial dyestuffs and as disinfectants. Ortho- and para-cresols are white solids; meta-cresol is a liquid. They all possess the odor of phenol or carbolic acid.

Crespin, Jean, d. 1572. French Protestant, settled in Geneva 1548. *History of Martyrs*, 1554.

Crespy. In n. France. By a treaty signed here Sept. 18, 1544, Francis I. renounced Italy and Charles V. Burgundy.

Cress, Garden. *Lepidium sativum.* Herb of the Mustard family, native of w. Asia, cultivated for salad; known also as Peppergrass.

Cress, Mouse-Ear. *Stenophragma thalianum.* Low herb of the Mustard family, native of Europe, introduced as a weed into N. America.

Cress, Rock. Herbs of the genus *Arabis* of the Mustard family; of wide geographical distribution.

Cress, Water. *Roripa nasturtium.* Perennial herb of the Mustard family, growing in rivers and brooks, native of Europe, naturalized in America and Australia; largely used as a salad.

Water Cress (*Roripa nasturtium*).

Cress, Winter. Yellow-flowered. vernal herbs of the genus *Barbarea*. natural family *Cruciferæ*, natives of cooler parts of n. temperate zone; naturalized as a weed in e. N. America; known as Yellow Rocket.

Cressy. See Crecy.

Crest. Surmounting a helmet with the figure of some real or fabulous animal is a very ancient practice; but, as a heraldic ornament, the crest does not appear in w. Europe till the 13th century. It either rests on a wreath or issues from a ducal coronet, mural crown, or cap of maintenance. It is not indispensable in a coat of arms, as many continental families bear no crest; nor is it any way distinctive, since the same crest appears on many shields, and branches of the same family are found with various crests.

Crest. Line of intersection when the bounding plane surfaces of a parapet make a salient angle. *E.g.*, that of the interior and superior slopes is the interior crest, that of the superior and exterior slopes the exterior.

Cresting. Ornament, in terra cotta, wood or metal, crowning the ridge of a roof.

Crest of a Weir. Top over which the water flows. This should be long enough, in case of a storage reservoir, to allow the discharge of flood water. The disaster at Johnstown, Pa., in 1889, by which ab. 2,200 lives were lost, was caused by the failure of a dam whose waste weir was insufficient in length and depth.

Creswell, Sir Creswell, 1794–1863. M. P. 1837, Judge of Common Pleas 1842, of Probate 1858. *Reports*, 1822–30.

Creswell, John A. J., 1828–1891. M. C. from Md. 1863–65; U. S. Senator 1865; Postmaster-Gen. 1869–74.

Creswick, Thomas, 1811–1869. English landscape painter and illustrator.

Cresylic Acid. Old name for Cresol (q.v.).

Cretaceous. Uppermost division of Mesozoic rocks, so called from the chalk beds of England and Europe. It is remarkable for the number of genera of Mollusks and Reptiles ending with it, and for the appearance of modern types of plants.

Cretan Bull. See Minotaur.

Crete, or **Candia.** Large island in the Mediterranean, s. of the Ægæan Sea, 150 m. long, 7 to 35 m. wide. Homer credited it with 100 cities. King Minos gave it laws and a navy. It was settled by Dorians, conquered by the Roman Metellus 68 B.C.; by the Venetians 1205, and by the Turks 1669. Insurrections occurred 1821, 1859, 1866–69, and 1891. Pop. ab. 300,000.

Crétineau-Joly, Jacques. 1803–1875. French priest, historian of the Jesuits, 6 vols., 1844–46; of Clement XIV., 1853; of the Vendean war, 4 vols., and of Louis Philippe, 1861–63.

Cretinism. Incurable congenital disease very common in the valleys of the mountainous parts of Europe; also found in all portions of the world, under the most varying conditions of climate; characterized by arrested development and premature ossification of the bones of the head and limbs, the patients being dwarfed, more or less idiotic, and with the thyroid gland enlarged (goitre). The drinking of snow water, coitus while intoxicated, and a host of other conditions have been assigned as causes, but some unknown climatic and geological conditions and congenital disease of the thyroid gland are probably at the bottom of the disorder.

Cretonne. Cotton fabric, thick, strong, and unglazed, with colored designs printed upon it, used principally for curtains and furniture coverings.

Creusa. Daughter of Priam and Hecuba; wife of Æneas. She died at the capture of Troy.

Creuzer, GEORGE FRIEDRICH, 1771–1858. Prof. Heidelberg 1804–45. *Symbolism and Mythology*, 4 v., 1810–12.

Crevettina. Tribe of Amphipods, with small head and eyes, and a pair of leg-like maxillipeds. Sand-flea is a species.

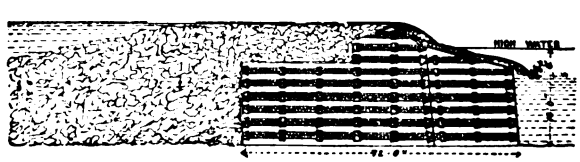
Crevice. 1. In placer-mining, narrow fissure in the bed-rock, where there has been a natural concentration of gold. 2. Fissure in rocks, in general.

Crib. Structure of logs or timbers, filled with stone and forming the lower part of a pier or bridge: or, a framework without a bottom, sunk by dredging from the interior while masonry is built upon it. Very deep foundations have been sunk by the second method, the deepest being the piers of the Hawkesbury Bridge in Australia, 170 feet.

Crib. See CURB.

Cribbage. Game of cards, with a full pack, played by two, three, or four persons. Two-hand cribbage is played with 5 or 6 cards, in either of which games 2 cards are discarded by each player for the crib, which belongs to the dealer. The game is 61. The six-card game is the most common. In cutting the cards, if the dealer turns a Jack, he counts 2. The playing is alternate turning of a card at choice, the non-dealer leading. The counts are pairs 2, triplets 6, quartets 12, sequences of three or more cards, an equal number of points, 15 points by card pips and nearest to 31 by card pips 1, 31 gives 2; all these counts to the player making them. Also, the player can add to his score the value of his hand and the crib in a similar manner, using the card turned in cutting with both; in addition 4 of the same suit counts 4, with the turned card 5; in the crib this count can be made only when the turned card is of the same suit; Jack of the turned suit 1. In the three and four-hand game, 1 card is discarded by each for the crib, and in the former another card is added from the pack for the crib. The four-hand game is played as partners.

Crib-Dam. Dam built of logs or timbers, the spaces between them being filled with stones. Extensively used for



Crib-Dam in the Schuylkill at Philadelphia.

small structures. One of the largest is the dam over the Connecticut at Holyoke, Mass.

Cribrarieæ. Order of *Myxomycetes* or Slime-moulds.

Cribriform. Vegetable tissue composed of cells provided with certain plates or portions of the cell-walls, perforated by numerous minute apertures. These cells occur most abundantly in the inner bark, and the perforated areas are called Sieve-plates.

Cribrose-Cells. See SIEVE-CELLS.

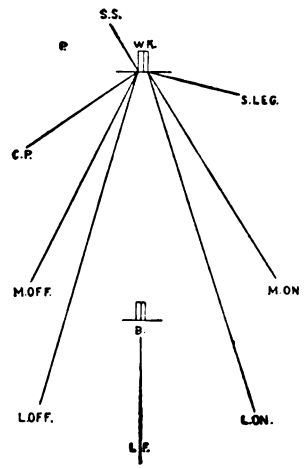
Crichton, JAMES, "THE ADMIRABLE," 1560–ab 1586. Scottish phenomenon, whose talents and attainments were probably enlarged by popular rumor.

Cricket. See GRYLLIDÆ.

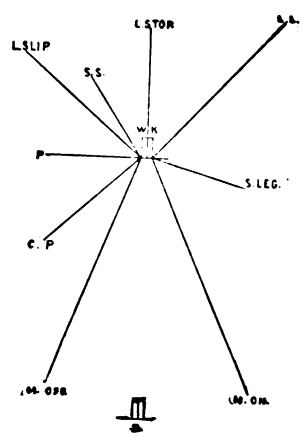
Cricket. One of the oldest and the most popular game of those played with bat and ball among Englishmen and in English-speaking countries; it originated ab. 1250, the word "Cricket" appears first 3 centuries later. In some, as in America, other sports, such as baseball, dispute the popularity of cricket or take its place. This is true in the colleges and universities of the U. S., where cricket is played but little. The game is played by twenty-two men, eleven on a side. One of these sides goes into the field while the other side sends two men in as batsmen, one before each wicket.

In the early days of cricket there was no wicket, but a hole in the ground answered this purpose. About 1700 two stumps were used in place of the hole, and a third was added in 1775. In 1817 the stumps attained their present dimensions. These wickets are now composed of three upright sticks called stumps, set in the ground so as to project above it twenty-seven inches, on top of which is laid the bail, two short pieces of stick. A line is drawn through the bases of these stumps called the line of the stumps, and a second a pace and a half (four feet) in front of this called the popping crease. Between these lines is the batsman's ground, and back of the line of the stump is the bowler's ground.

The side which has gone into the field arranges its men in a suitable fashion to catch or stop the ball when hit by the batsman, and the formation varies for different kinds of bowling, because by this the batting is correspondingly affected. The general formation is, however, given in the annexed diagram.



Position of Field for Slow Bowling.



Position of Field for Fast Bowling.

There are two bowlers, and play having been called by the umpire at the bowler's wicket the game begins, and the bowler proceeds to deliver five balls to the opposite wicket, which constitute what is called an over, after which the other bowler does the same from the opposite wicket; this change in bowlers involving a corresponding change of the fielders in their positions. This process goes on until one or the other of the batsmen is put out, which may happen in any one of the following ways: bowled out, that is, the wicket is bowled down; caught out, that is, if the ball he has hit be caught and held by a fielder before it touches the ground; stumped out, that is, the bail be knocked off by the wicket keeper in possession of the ball when the batsman is out of his ground; run out, that is, if the bail be knocked off by a fielder in possession of the ball when the batsman is running and not yet in his ground; knocking his own wicket down with his bat; stopping a straight ball with his leg instead of his bat; handling the ball when it is in play; hindering a fielder from catching a ball; knocking off the bails with some part of his dress; running out of his ground before the bowler has delivered the ball and thus giving him a chance to put his wicket down. As soon as a batsman is thus put out another of the side takes his place at the wickets.

When thus the last two men of the side are in at the bat and one is put out the other carries his bat out; that is, only ten men are put out. If the match is to be played out it is played to the close of full four innings, two to each side, and the eleven scoring the greatest aggregate of runs in their two innings wins the match. If it be for one day's play only, and there be not time to play out the second innings, the game is decided by the full score of the first innings only.

Crillon, LOUIS DES BALBES DE BERTON DE, 1541–1615. French soldier, styled "The Brave," eminent under Henry III. and Henry IV.

Crime. Act forbidden by law under pain of punishment by the State; if punishable with the forfeiture of lands or goods it was a felony at common law, otherwise a misdemeanor. The definition and classification of crimes are now generally declared by statutes.

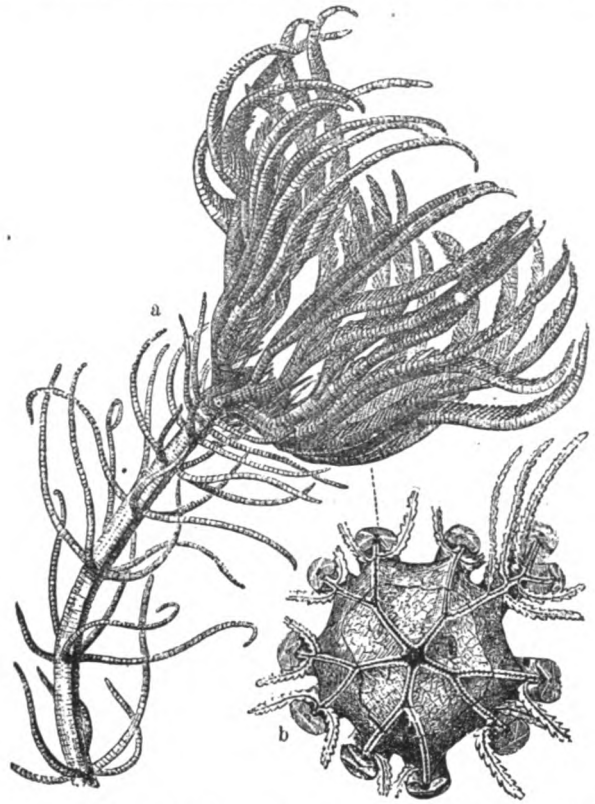
Crimea. Peninsula of Russia, projecting into the Black Sea and separating from it the Sea of Azov, connected with the mainland by the Isthmus of Perikop. It is known as the scene of a war between Russia and Turkey, supported by England, France, and Sardinia, 1854–55. Sevastopol was first attacked Oct. 17, 1854, and evacuated Sept. 9, 1855. The battle of Balaklava, Oct. 25, 1854, is famous for the Charge of the Light Brigade; that of Inkerman, Nov. 5, ended in a repulse of the Russians. The French took the Malakoff Sept. 8, 1855. The loss of life in field and hospital was heavy. Peace was declared March 30, 1856.

Criminal Law. The body of rules defining criminal acts and regulating the procedure for their punishment. In every legal system wrougful acts are first dealt with as torts, giving to the person injured a cause of action; later, when it is seen that the injurious consequences of such acts extend beyond the suffering individual to the State, they are made punishable by public prosecution. In Britain, Parliament may declare any act to be a crime. In U. S., the act must be one tending to harm the community. The substantive law as well as the pro-

cedure, in the various States, rests upon English common law; but the Federal Government has no criminal common law, it is wholly statutory.

Crimp. Keeper of a boarding-house for sailors, gaining their custom by promises of employment. A new berth is indeed found for the victims, but not until they have been thoroughly fleeced. London in the past had an unenviable notoriety for crimps, but New York, Shanghai and San Francisco are now supreme.

Crinoidea ("STONE-LILIES"). Echinoderms with cup-shaped bodies (calices), born on a fixed, jointed stalk, attached at the aboral pole, and bearing five-branched, jointed, and pinnulate arms that are independent of the visceral cavity.



a, Pentacrinus caput medusæ; *b*, formation of stalk after arm is cut off.

The mouth and ventral surface are turned uppermost. The generative cells develop on the ventral surface of the pinnæ. All modern representatives belong to the group Neocrinoids or *Articulata*. Fossils fall mostly into the group *Tesselata* or Palæocrinoids.

Crippling of Beams. Failure of thin beams by sidewise bending. To prevent this, stiffeners are sometimes placed along the sides, as in plate girders.

Crisafulli, HENRI, b. 1827 in Naples. French dramatist and novelist. He produced *Giroflé*, 1858, jointly with E. Devicque, and pub. *Les Invisibles de Paris*, 5 v., 1866–67, with G. Aimard.

Crisis. That point in any condition of things where further development hangs in suspense until a proper cause determines whether the tendency is progressive or regressive.

Crisp, CHARLES FREDERICK, b. 1845 in England. Judge Ga. Sup. Ct. 1877; M.C. since 1883; Speaker 1891.

Crispi, FRANCESCO, b. 1819. Prime Minister of Italy; Pres. Chamber of Deputies repeatedly.

Crispin, ST. Patron of shoemakers; martyred in France 287, and celebrated Oct. 25.

Cristatella. See PHYLACTOLÆMATA.

Cristofori, or **Cristofali,** BARTOLOMMEO DI FRANCESCO, 1651–1731. Inventor of the PIANOFORTE (q.v.). He was a harpsichord-maker in Florence.

Criterion. Standard or determinant of the validity or legitimacy of any fact; such rule or principle as enables us to distinguish truth from falsehood and right from wrong.

Critias, ab. 456–404 B.C. Greek orator and author, pupil of Socrates, and one of the 30 Tyrants of Athens.

Critical Angle. Maximum angle of incidence at which a ray of light will emerge, when meeting the surface of an optically less dense medium. If the second medium be vacuum, the absolute index will be u, the angle of refraction will be $\frac{\pi}{2}$, and hence u, which is equal to $\frac{\sin r}{\sin i}$, will be $\frac{1}{\sin i}$; the sine of the critical angle is the reciprocal of the refractive index. The critical angle for crown glass is about 41° 48′; that for water about 48° 35′.

Critical Pressure. Pressure necessary to liquefy a substance from the state of a vapor at the critical temperature; pressure exerted at the critical state.

Critical State. Condition of a vapor, defined by its temperature and pressure, in which, if the temperature be decreased or the pressure increased, the vapor will liquefy. Under these circumstances, by no optical test can the vaporous and liquid conditions be distinguished. Dr. Andrews made many experiments in studying these phenomena. For carbon dioxide the critical temperature and the pressure are 30.92° C., and ab. 73 atmospheres. See ANDREWS, THOMAS.

Critical Temperature. Highest temperature at which a substance will remain liquid, however great the pressure.

Criticism. Method in philosophy and literature by which doctrines are examined and analyzed to see whether they conform to certain general and accepted principles.

Crito. 1. Friend and disciple of Socrates. 2. Title of one of Plato's dialogues.

Critolaus. Peripatetic philosopher at Athens; Envoy to Rome ab. 155 B.C.

Crittenden, JOHN JORDAN, 1787–1863. U. S. Senator from Ky. 1817–20, 1835–41, 1843–48, and 1855–61; U. S. Attorney-Gen. 1841 and 1850–53; Gov. of Ky. 1848; M.C. 1861.—His sons, GEORGE BIBB, 1812–1880, and THOMAS LEONIDAS, b. 1815, were generals on opposite sides in the Civil War, the former in the Confederacy.

Crivelli, CARLO, ab. 1435-ab.1500. Venetian painter, in style hard and dry, but conscientious in work and devout in feeling.

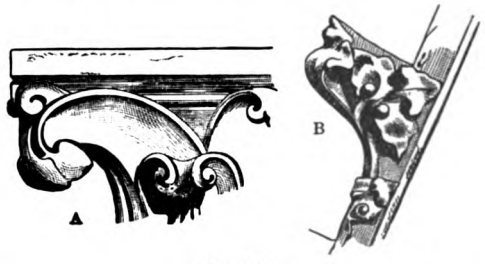
Croatia. Austro-Hungarian province, n. of Bosnia, between the Drave and the Adriatic; part of the ancient Pannonia; settled ab. 650 by Slavic immigrants, subject to the Byzantines till ab. 900, and to Hungary from 1097. Area 5,246 sq. m., or 16,352 with Slavonia and the Military Frontier, united 1881. Total pop., 1890, 2.184,414, mostly R. C. Slavs.

Crocein. Usually sodium salts of the sulpho acids; prepared by the action of the diazo compound of amidoazobenzene on the naphthol sulphonic acids; reddish-brown powders; important red dye-stuffs.

Crochet. In Gothic architecture, an ornament projecting at equal intervals from the side of a canopy, hood molding, gable, or from the angle of a spire or pinnacle.

Crocidolite. Fibrous silicate, containing ferrous oxide. A S. African variety, probably a product of alteration, shows when polished beautiful greenish-yellow reflections, and is called tiger stone or tiger-eye.

Crockets. Curved ornaments in Gothic architecture. Usually projecting leaves, flowers, or bunches of foliage, and



Crockets.
A, from choir of Notre Dame, Paris, ab. 1160; B, gable crocket, 14th century.

decorate the angles of spires, canopies, pinnacles, and gables.

Crockett, DAVID, 1786–1836. Western pioneer; M. C. from Tenn. 1827–31, 1833–35; killed at the Alamo, Texas. *Autobiography*, 1834.

Crockett, SAMUEL RUTHERFORD, b. 1861. Scottish novelist. *The Stickit Minister*, 1893; *The Raiders*, 1894.

Crocodile. Found in both hemispheres, but especially in Africa; they swarm on the Upper Nile. They have snouts of a width medium between Gavials and Alligators. The plates on the head are separated from those on the back, and the

Crocodile.

teeth of the lower jaw fit into notches on the sides of the upper. They are scavengers, but often attack animals that come to drink, and even human beings, knocking them insensible with a blow of the tail. A length of 12 feet is attained. See PROCŒLIA.

Crocodile Bird. *Pluvianus.* Black-headed Plover of Egypt. It feeds on leeches and other parasites infesting the skin and mouth of the Crocodile.

Crocodilia, or LORICATA. Order of *Hydrosauria*, having bony dermal plates, teeth in sockets, long clawed feet, and keeled swimming tail. The eyes have vertical pupils, lids, and nictitating membrane. The alimentary tract is bird-like, the ventricular cavities of the heart are separated, thus approaching the nearest to the heart of warm-blooded animals. The body cavity opens by abdominal pores, as in Selachians. There are three sub-orders: *Procœlia* (Crocodiles and Alligators); *Teleosauria*, with biconcave vertebræ, hence also called *Amphicœlia;* and *Steneosauria*, also called *Opisthocœlia*, from the form of the vertebræ. The latter groups are found only as Jurassic fossils. The order is characterized by the possession of abdominal ribs and sternum, which are not homologous with the other ribs, but are only dermal plates. See BELODONTIDÆ.

Crocoite. $PbCrO_4$. Lead chromate, first found in Siberia; named from its saffron-like color.

Crocus. Bulbous herbs of the natural family *Iridaceæ*, natives of Europe, mainly blooming in early spring, and widely planted for their ornamental flowers.

Crœsus. Last king of Lydia, 560–546 B.C.: famous for his wealth. He drew to his court at Sardis all the wise men of Greece, but was defeated by Cyrus.

Croft, WILLIAM, Mus. Doc., 1677–1727. Organist at Westminster Abbey 1708. *Anthems*, 1724.

Crofters. Small tenant farmers in w. Scotland and adjoining islands. Their grievances were investigated 1883, and partially relieved by the Holdings Act, 1886.

Croker, JOHN WILSON, 1780–1857. Irish author; tory M.P. 1807–32; Sec. Admiralty 1809–30; founder, with Scott and Canning, of the *Quarterly Review*, 1809, and one of its sharpest writers; ed. Boswell's *Johnson*, 1831. His *Stories from the History of England* moved Scott to write *Tales of a Grandfather.* Disraeli satirized him as "Rigby" in *Coningsby.*

Croker, RICHARD, b. 1843 in Ireland. N. Y. Alderman 1867; head of Tammany Hall 1886–94.

Croker, THOMAS CROFTON, 1798–1854. Irish author and compiler. *Researches*, 1824; *Fairy Legends and Traditions*, 1825; *Legends of the Lakes*, 1828; *Barney Mahoney*, 1832; *Popular Songs of Ireland*, 1832; *Memoirs of Joseph Holt*, 1838.

Croll, JAMES, LL.D., F.R.S., 1821–1891. Keeper of a museum at Glasgow 1859; on Geol. Survey of Scotland 1867–81; author of 90 memoirs and papers on geologic climatology. His *Climate and Time*, 1875, developed the ECCENTRICITY THEORY (q.v.) of the cause of glacial periods.

Croly, GEORGE, LL.D., 1780–1860. Irish poet, rector in London from 1835. *Salathiel*, 1827; *Personal History of George IV.*, 1830; *Political Life of Burke*, 1840; *Marston*, 1846.

Croly, MRS. JANE CUNNINGHAM ("JENNIE JUNE"), b. 1831, m. 1856. American journalist of English birth, promoter of women's clubs and congresses, and author of several books.

Crome, JOHN, 1768–1821. English painter. *Mousehold Heath* and other works of his are in the National Gallery, London.

Cromlechs. Prehistoric megalithic monuments, consisting of two or more uprights supporting a flat stone; now

Cromlechs at Stonehenge, Eng.

considered to be simply the uncovered chambers of former BARROWS (q.v.); more properly called DOLMENS (q.v.). In France, stone circles.

Crompton, SAMUEL, 1753–1827. English weaver, inventor of the spinning-mule 1779. This device, which enriched many and benefited mankind, brought him small returns, and he died in poverty.

Cromwell, OLIVER, 1599–1658. Lord Protector of England. M.P. 1628 and 1640; commander of the left wing at Marston Moor 1644, and of the right at Naseby 1645; leader of the Independents, and member of the Court which condemned the King 1649. He subdued the Irish Royalists; became commander-in-chief 1650; defeated the Scots at Dunbar Sept. 3, and Charles II. at Worcester 1651; dissolved the "Rump" Parliament 1653, and became Lord Protector, but refused the title of king. The ablest general of his time, he

Oliver Cromwell.

proved to be, though uncrowned, the greatest of English sovereigns: he made England respected and feared abroad, protected foreign Protestants, and ruled wisely at home, though in an anomalous position, under vast jealousies and increasing difficulties.—His character and motives are still matters of controversy: the safest opinion regards him as neither hypocrite nor saint.—His son RICHARD, 1626–1712, a peaceable and unambitious man, succeeded him as Protector, but resigned April 1659, and lived abroad till 1680.

Cromwell, THOMAS, EARL OF ESSEX, 1485–1540. English courtier and minister; employed by Cardinal Wolsey; promoter of the Reformation; Secretary of State 1534; commissioned to suppress the monasteries 1535; Baron 1536, Earl 1540; executed as a traitor.

Cronica General. Earliest collection of Spanish Chronicles; made by Don Alfonso in 13th century, and extending from the Creation to 1252.

Cronos. Son of Heaven and Earth; father of Jupiter, Juno, Neptune, Pluto, Ceres and Vesta; dethroned by Jupiter.

Cronstadt. Fortified seaport of Russia, and its principal naval station, on island of Kotlin, near head of Gulf of Finland. Pop. ab. 49,000.

Cronwright, MRS. See SCHREINER, OLIVE.

Crook, GEORGE, U.S.A., 1828–1890. Major-Gen. 1888; in command of western departments 1866–82; very successful in his management of turbulent Indians.

Crookes, WILLIAM, F.R.S., b. 1832. English chemist and physicist; founded *Chemical News*, 1859; ed. *Quarterly Journal of Science*, 1864. He received the gold medal of the French Academy of Sciences 1880.

Crookes' Layer. Any mass of liquid in the spheroidal state supported by the impact of a layer of molecules whose mean free path, in the language of the kinetic theory of gases, is greater than the distance between the solid and liquid surfaces.

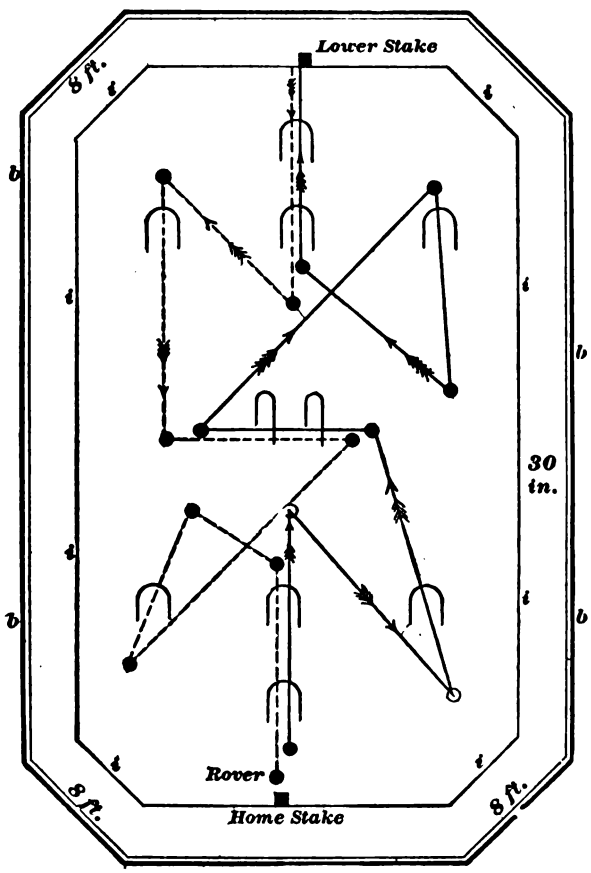
Crookes' Tubes. Glass bulbs and tubes devised by Crookes for studying the electric discharge in high vacua. The exhaustion usually is upward of one-millionth of an atmosphere.

Crooks, GEORGE RICHARD, D.D., LL.D., b. 1822 in Phila. Ed. *Methodist*, 1860–75; prof. Drew Theol. Sem. 1880. He pub. Lives of Dr. John McClintock 1876, and Bp. Simpson 1880, joined the former in preparing Latin and Greek text-books, and Bp. Hurst in a *Theological Encyclopædia*, 1884.

Croppings. Portions of a mineral deposit that appear at the earth's surface.

Crop Rotation. System of following one crop with another unlike it. Two principles govern the best rotations. One is to follow a deep-rooting crop with a shallow, and vice versa; the other is to so arrange crops that there shall be a living plant on the soil during as much of the year as possible.

Croquet. French in origin, this game was brought to England probably about the middle of the present century. In 1867 public match games were played. Championships were contested under the "All England Club" at Wimbledon. In America it became a popular game in the seventies, and a few years later waned in general public favor, but was taken up as



Croquet Field.

a scientific sport and developed experts. As such a game it is still played. The principle involved is that of driving a ball by blows of a mallet successively through a number of wickets. The accompanying diagram of field under rules of the National Croquet Association illustrates this. It can be played by any number from two up.

Crosby, HOWARD, D.D., LL.D., 1826–1891. Presb. pastor in N. Y. from 1863; Chancellor Univ. N. Y. 1870–81; N. T. reviser. *Lands of the Moslem*, 1850: *Seven Churches of Asia*, 1890.

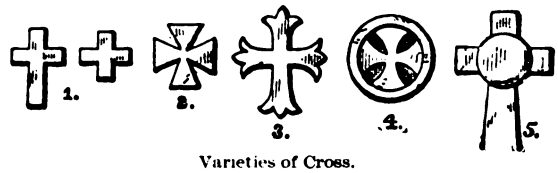
Crosier. See PASTORAL STAFF.

Crosland, MRS. CAMILLA (TOULMIR), b. 1812, m. 1848. English novelist. *Young Lord*, 1849; *Lydia*, 1852; tr. Hugo's *Hernani*, 1887.—Her husband, NEWTON, is an essayist. *Apparitions*, 1856–73; *Pith*, 1881.

Cross. Instrument used of old for execution of slaves and criminals. That on which our Lord suffered was doubtless the *crux immirsa*, or ordinary cross, not the *crux commirsa*, or T-shaped, nor the *crux decursata*, or X-shaped cross.

Cross, ANTE-CHRISTIAN. The use of the cross symbol before the Christian era or outside of Christian influences is a well-defined fact, attested by the "Relief of the Cross" at Palenque in Yucatan, and by many other monuments of ancient American as well as Mediterranean art. It appears to have been a sign of the Four Quarters or Directions with many primitive peoples. It was also undoubtedly one of the variants of the SWASTIKA (q.v.). The Latin cross is worn as an amulet by a captive represented in an Egyptian relief, and appears on a Cypriote cylinder seal. The Greek cross is the ordinary Ante-Christian form, thus found in gold by Dr. Schliemann at Mycenæ and seen on Cypriote pottery. That at Palenque is a Latin cross.

Cross, CHRISTIAN. Four distinct forms of this symbol are known. The Latin has the form of the actual cross; the Greek has arms of equal length; the Maltese has equal arms which widen toward the ends and are shaped like triangles; the Coptic is composed of lotus trefoils. The two latter forms were probably once identical. As an architectural decoration and re-



Varieties of Cross.

ligious symbol, the cross was almost always attached to mediæval churches in conspicuous positions, such as the points of spires or gables. Preaching crosses were set up in the public roads; especially in England, and the finest examples of memorial crosses are those erected in that country by Edward I. in memory of Queen Eleanor.

Cross, MRS. ADA (CAMBRIDGE), b. 1844, m. 1869. Anglo-Australian novelist and poet. *Hymns*, 1865–66; *My Guardian*, 1878, *Mere Chance*, 1882.

Cross, MARY ANN. See ELIOT, GEORGE.

Cross Aisle. Old name for transept.

Cross and Pile. Old English game, now known as "Heads and Tails." Old English coins were stamped on one side with a cross.

Crossbills. *Loxia.* Most highly developed members of the Finch family, characterized by having the tips of the upper and lower bills crossing so as to facilitate extraction of seeds. Males are reddish, females brownish-olive in general coloration. See CONIROSTRES.

Cross-Bow. Weapon of war and the chase, called also arbalest, superseded by the long-bow at the end of the 13th century. It consisted of a steel bow set in a wooden shaft, furnished with a string and trigger, and bent with an iron lever.

Cross-Bred. Result of the union of two animals of distinct breeds.

Cross Course. In mining, a vein, usually without ore, intersecting another vein.

Cross Cut. 1. Horizontal passage in country rock driven from a shaft to intersect a vein. 2. Drift in a vein running from wall to wall transverse to the strike; or passage driven at a large angle with the direction of the main workings.

Crosse, ANDREW, 1784–1855. English electrician, maker of artificial crystals.

Crossed Check. One bearing the words "& Co."; payable only into a bank; much used in England.

Cross-Examination. Questions put by counsel on the side opposed to that by which a witness is called, and his answers thereto; following direct examination.

Cross-Eye. See SQUINT.

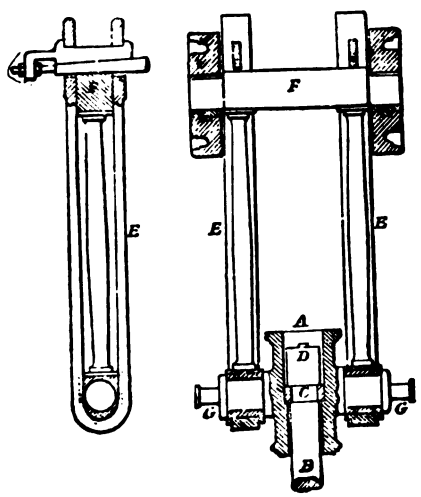
Cross-Fire. Peculiar disturbance or reactionary effect observed on parallel telegraph or telephone circuits; supposed to be due primarily to induction, and secondarily to earth currents, atmospheric electricity, and leakage caused by imperfect insulation.

Cross-Fire. When the perpendiculars of two near or adjacent parapets intersect at an angle of ab. 90°, the ground in this vicinity is said to be subject to cross-fire, for the reason that the fire from any parapet is generally delivered perpendicularly to its crest.

Cross Girts. Cross beams or girders which carry the wheels at the ends of a turn-table.

Cross Hairs. See CROSS WIRES.

Crosshead. Sliding organ in an engine design, guided so as to give a linear motion to the end of a piston rod, and to resist the deflection which the angularity of the connecting rod would cause if free to act. It may have one, two, or four guides. Where there is one guide, the crosshead surrounds it on all four sides (it is usually rectangular); where two, it stands vertical, and the guides are over each other and in the



Crosshead and Side-links of Parallel Motion for Piston-rod of Cornish Engine.

A, Crosshead. *B*, Piston rod. *C*, Loose collar. *D*, Key. *E*, Links. *F*, Beam gudgeon. *G*, Bearings for parallel bars.

same vertical plane as the piston and connecting rods; where four, it is horizontal and a pair of guides is above and below it on each side of the plane in which the piston and connecting rods operate. The slipper crosshead, applicable to engines which "throw over" on the outgoing stroke and are not reversed, has one wide bearing surface on the bottom, which can be kept thoroughly lubricated without attention. Where the end of the piston rod is guided by links, little remains of the crosshead but the pin.

Cross-Heading. Passage opened for ventilation between two galleries or working places in a mine, transverse to the direction of the workings.

Crossing. See HYBRIDIZATION.

Cross Keys. In Rockingham co., Va., scene of a battle, June 8, 1862, between Gens. Fremont and Jackson.

Crossopterygii. Tribe of Ganoids with broad jugular plates instead of branchiostegal rays; and with pointed diphycercal tail; the fins as well as body are covered with scales, which may be either thin and cycloid, or strong and rhomboid. The "Mud-fish" of Africa (*Polypterus*), with rhomboid scales, and a dorsal fin divided into many small ones, illustrates the group. This fish unites the Ganoids with the *Dipnoi* and *Amphibia*.

Cross Section. Shape, or area, of an object made by a plane cutting it at right angles to its length. The area of the section of a wrought-iron bar in sq. inches is one-tenth of its weight in lbs. per linear yard.

Cross-Section Paper. Paper ruled into squares, used for plotting profiles and other curves, or for drawing figures approximately to scale.

Cross, SOUTHERN. *Crux.* Bright constellation between the legs of the Centaur ab. 40° from the Southern Pole. It consists of four bright stars forming a cross with slightly-tilted arms, and was named as a constellation by Royer 1679.

Cross Tag. Form of tag or touch in which the pursuer must transfer his chase from the one he is following to any other who crosses between the pursued one and himself. If several cross at the same time he must pursue the one who crossed nearest to him.

Cross Ties. Timbers placed underneath and at right angles to the two rails of a railroad track. The number of cross ties in use on U. S. railroads is estimated at nearly 400,000,000, one-sixth of which are renewed yearly at a cost of ab. 50 cents apiece. Metallic cross-ties may come into use, with the increasing cost of timber.

Cross Vein. Vein intersecting another, and therefore of later origin.

Cross-Wires. Two fine filaments of spider-web, silk or platinum, usually at right angles to each other and placed in the focus of the eye-piece of a telescope or micrometer microscope. The image formed by the object-glass is in the same plane as the cross-wires, and thus the latter may be brought coincident with any part of it desired. They are of use in measuring microscopic objects or indicating the position of a distant object through a telescope.

Crotalus. See SOLENOGLYPHA and RATTLESNAKES.

Crotch, WILLIAM, 1775–1847. English doctor of music, who picked out melodies on the organ at two years of age, and at five played publicly in London; composer of oratorios and church music.

Crotchet, or INDENTATION. Sudden short break in the line of crest, after which the line takes again the same direction; *e. g.*, the crest of the covered way is frequently thus broken, to permit the passage of troops on its side, out of the direct view of the enemy.

Crotona. Ancient city of s. Italy, founded by Achæans 710 B.C. It destroyed Sybaris 510 B.C., decayed not long after, and is now a village, Cotrone.

Croton Aqueduct. See AQUEDUCT.

Croton Chloral. $CH_3.CHCl.CCl_2.CHO$. Trichlorbutyraldehyde. Its combination with water, which is found in trade in white crystals, is known as croton chloral hydrate. Liquid boiling at 168°–167° C., prepared most commonly by the action of chlorine upon cold aldehyde; used as a soporific.

Crotonic Acid. $CH_3.CH{:}CH.COOH$. Mpt. 72° C. Unsaturated solid acid, found in pyroligneous acid, and prepared synthetically.

Croton Oil. Oil obtained from the seeds of *C. tiglii;* very violent cathartic and irritant of the skin.

Crotonylen. See BUTINE.

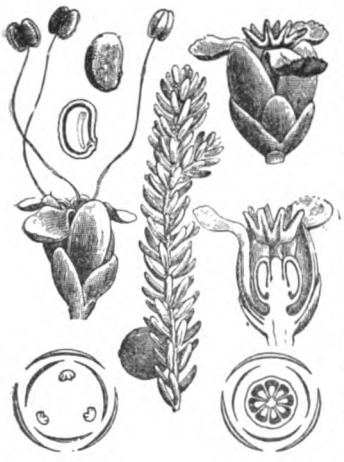
Croup. Acute, very fatal, inflammation of larynx with formation of membrane (whence appellation membranous croup), upon mucous membrane, often of sufficient extent to cause death by suffocation. It occurs usually before 7th year, oftener in males than in females, is accompanied by frequent suffocative attacks, crowing respiration, and a harsh, metallic cough. Death usually results in from two days to a week, the period depending upon extent of false membrane and strength and age of patient. By some it is regarded as a form of diphtheria. False croup is any affection of the larynx in which the cough and respiration have the above characters.

Crova, ANDRE. b. 1830. Prof. Montpellier, France. *Solar Radiation; Hygrometry; Clouds.* Inventor of dewpoint apparatus; and of the continuous self-registering and absolute actinometer.

Crova's Actinometer. Blackened bulb thermometer, surrounded by a blackened inclosure, kept at the temperature of melting ice; the rate of change of temperature of the thermometer is measured when the sunlight is admitted to and cut off from it.

Crow. *Corvidæ.* This family includes also JAYS (q.v.), Magpies, etc. The true crows are large, with long wings, short tail, conical bills, black plumage, rapacious, and cunning. The Raven, the European Carrion Crow and Chough are examples. (American Carrion Crow is a Vulture.) Our Common Crow nests in trees in March and by June a second brood have been hatched. Notorious as eating seed corn, they are mainly feeders on grubs turned up by plow; they will not touch corn washed in coal tar. The American Blackbird (*Quiscalus*) is a crow. See DENTIROSTRES.

Crowberry. *Empetrum nigrum.* Widely distributed low shrub of the natural family *Empetraceæ*, occurring especially in colder climates.



Empetrum nigrum.

Crowberry, Broom. *Corema conradii.* Insignificant but highly interesting plant of the natural family *Empetraceæ*, native of n.e. N. America.

Crowe, Mrs. Catherine (Stevens), 1800–1876. English author. m. 1822. *Lilly Dawson*, 1847; *Night Side of Nature*, 1848.

Crowe, Joseph Archer, b. 1825. English journalist and art critic.

Crowfoot. Various species of the genus *Ranunculus*, natural family *Ranunculaceæ*, of wide geographical distribution.

Crow Indians. Branch of the Dakotas, a marauding tribe of fine physique still living on their original grounds in Montana. Many hold lands in severalty, stock and horses. Crow Reservation consists of 7,364 sq. m. and contains 2,287 Indians.

Crown. Originally a mere fillet or ornamental wreath or garland worn on festal occasions. Oriental rulers came to assume it as an emblem of authority, and the republics of Greece and Rome bestowed it as a reward for success in public games and for services to the State. The *Corona civica*, of oak leaves, was conferred on him who had saved the life of a citizen. He wore it at the spectacles and sat next the Senate, the audience rising on his entrance as a mark of respect. The first to scale the walls of a city received the *Corona muralis;* and the first to mount the rampart or enter the enemy's camp received the *C. vallaris* or *castrensis. C. navalis* was given for naval exploits, and *C. obsidionalis*, made of grass, to the general who broke a blockade; while *C. triumphalis* was worn by the successful general at his triumph. Crowns worn emblematically were the nuptial, convivial, funereal, and sacerdotal. Modern crowns are derived from the Oriental diadem. Famous examples are the Iron Crown of Lombardy, lined with a nail from the True Cross, and the Papal Tiara, a triple coronet surrounding a tall uncleft miter topped with a ball and cross, first adopted by Benedict XII., 1344.

Crown Glass. For optical purposes it is made of sand, chalk, pearl ash, and soda ash with a little arsenious oxide. It is melted in pots, cooled, and broken horizontally. The clear pieces are selected, softened by heat, molded in form, cooled and polished for lenses. For window glass, made only in England by this method, crown glass contains no pearl ash and is blown in the form of globes, which are welded by glass to a rod, opened opposite to the rod, and, by revolving rapidly, are expanded to a flat disk by centrifugal force. It is then annealed. This glass is more brilliant than plate or cylinder glass, but not as cheaply made as the latter.

Crown Imperial. *Fritillaria imperialis.* Bulbous plant of the Lily family, native of s. Europe and w. Asia, cultivated as a garden flower.

Crowning the Covered Way. When the siege operations have been so far successful as to permit the construction of a trench ab. six yards in front of and parallel to the covered way, the latter is said to be crowned. Breaching batteries are here located, and the last period of the siege is inaugurated.

Crowninshield, Frederic, b. 1845. American mural decorator and artist in stained glass. *Mural Painting*, 1887.

Crown of an Arch. Highest part of the arch near the keystone.

Crown of Cups. Earliest form of voltaic battery; composed of simple zinc-copper cells; devised by Volta; named from the circular arrangement of the cups.

Crown Point. Village of Essex co., N. Y., on Lake Champlain. A fort was built here by the French 1731, abandoned 1759, rebuilt by the British and taken May, 1775, by Americans.

Crown-Sheet. In a steam boiler, plate directly over the fire-grate. In locomotive practice it is either flat or slightly arched, and is stayed from collapse inward and downward either by flat crown-bars or by radial stay bolts. The total pressure upon the crown-sheet of a furnace whose area is 64 sq. ft. with a boiler pressure of 140 lbs. to the sq. in. amounts to 645 tons.

Crown Work. If through a point in front of a military bridge two right lines be drawn, making such an angle with each other that the lines will be perpendicular to the river banks, and on these lines as exterior sides bastioned fronts be constructed, the resulting trace is a crown work.

Crow Steps. Same as Corbie Steps (q.v.).

Crowther, Samuel Adjai, D.D., 1812–1891. African bishop. Enslaved in childhood, he was taken by a British vessel, baptized 1825, ordained 1843, and after 20 years of missionary labor made Bp. of the Niger 1864. He pub. a Yoruba grammar and dictionary, and tr. the Prayer Book and parts of the Bible.

Croydon. Suburb of London, in Surrey. Pop., 1891, 102,697.

Crozer Theological Seminary. At Upland, Pa.; founded 1868 by Baptists. It has 8 professors, ab. 100 students, and an endowment of $378,500.

Cruciate. Flowers with four petals, spreading like the arms of a Maltese cross, as in those of the Mustard family.

Crucible. Melting pot for subjecting solid substances to high temperatures. The principal materials of which crucibles

Plumbago | French Clay | Porcelain Crucibles. | Platinum | Hessian

are made are clay and black-lead for metals, silver for the alkalies, and platinum for chemicals. Porcelain is also occasionally used.

Cruciferæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising ab. 220 genera and 1,800 species, widely distributed throughout all parts of the earth; commonly called the Mustard family. Corolla has four petals spreading in the form of a cross.

Crucifix. Cross with image of the Saviour's form thereon; used in the Eastern, Roman, and Lutheran Churches.

Crucifixion. Capital punishment originating in the East, where it is still known to the Chinese and Japanese. It was common to the ancient Persians, Egyptians, Carthaginians and Greeks. The Romans reserved it for slaves and great criminals. The victim died of exhaustion, hunger and thirst, and was left to be eaten by birds of prey. It was not common among the Jews till after the Captivity. Crucifixion was abolished by Constantine the Great, but it was found in Europe during the Middle Ages in isolated instances of tyranny.

Cruden, Alexander, 1701–1770. Scottish bookseller in London; author of the well known *Concordance*, 1737.

Cruelty. Infliction of unnecessary suffering; or malignant pleasure taken in the sight of others' pain.

Cruger, Mrs. Julia (Storrow). American novelist, writing as "Julien Gordon." *A Diplomat's Diary*, 1890; *A Successful Man*, 1890; *Vampires*, 1891; *Mlle. Réséda*, 1891; *A Puritan Pagan*, 1892; *His Letters*, 1892; *Poppæa*, 1895. Some of these have been tr. into German and other languages, the first and fourth by Spielhagen.

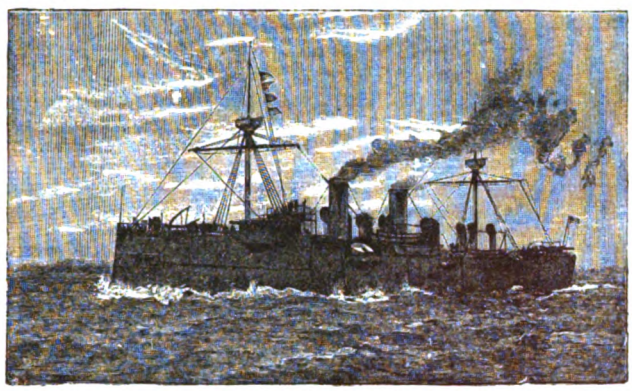
Cruikshank, George, 1792–1878. English genre painter and illustrator, famous chiefly for political and social caricatures.

Crus. Part of leg between ankle and knee.

Cruiser. Vessel armed with heavy ordnance, equipped for very high speed, and not very heavily armored, since she is designed to destroy the enemy's commerce and keep out of the way of battle-ships.

U. S. protected cruiser *Baltimore* is 327½ ft. long, 48½ ft. broad, 20½ ft. draught, 4,600 tons displacement, twin screws, triple expansion engine, 10,064 H. P., speed 19.575 knots per

hour. Armament, four 8-inch and six 6-inch breech-loading rifled guns; four 6-pounds, two 3-pounds, and two 1-pound



U. S. Cruiser *Baltimore.*

rapid firing guns; four Hotchkiss and two Gatling guns. Went into service 1889.

Crusade, THE CHILDRENS'. 40,000 German and 30,000 French children marched to the sea in 1212, expecting miraculous aid. Many perished, others returned discouraged; several thousand sailed away into oblivion; some became slaves to Mohammedans.

Crusades. Military expeditions to rescue the Holy Sepulcher from the Mohammedans. The rise of the SELJUKS (q.v.), the consequent persecution of pilgrims and desecration of holy places were the proximate causes. Pope Urban II. at the Council of Clermont, 1095, committed Christendom to the project. Europe was inflamed by itinerant preachers, and poured forth her blood and treasure for two centuries. There were seven crusades.

I. 1096–99. Four mobs, numbering ab. 275,000, were completely destroyed. The main army of 600,000 followed by way of Constantinople under Godfrey of Bouillon and others and captured Nice 1097, Antioch 1098, after 7 months' siege, and Jerusalem 1099. The Kingdom of Jerusalem (1099–1187) was erected, and Godfrey elected King.

II. 1147–49. Evoked by the endangered condition of Palestine. St. Bernard was the preacher, Conrad III. and Louis VII. the leaders. The armies perished in Asia Minor.

III. 1189–92. Caused by the capture of Jerusalem, 1187, by Saladin. Barbarossa led a German army, and died in Syria. Richard Cœur-de-Lion and Philip Augustus sailed from Sicily to Acre, which was taken after 2 years' siege and the loss of 300,000 men. Dissensions prevented further conquest, and a truce was agreed on. Richard was imprisoned in Germany on his return and paid a heavy ransom.

IV. 1203. Urged by Innocent III.; was diverted to Constantinople, which was taken and pillaged. The Latin Empire of the East (1204–1261) was established, with Baldwin of Flanders as Emperor.

V. 1228–29. By Frederich II., who concluded a treaty and was crowned at Jerusalem.

VI. 1249–54. Undertaken by St. Louis by way of Egypt; the army was destroyed and Louis captured, but released for a heavy ransom.

VII. 1270–72. Second attempt of St. Louis; diverted to Tunis, where he died. Prince Edward of England went to Palestine took Nazareth, and concluded a treaty. Acre, the last Christian stronghold in Palestine, fell 1291. The Crusades prolonged the life of the Eastern Empire, saved Europe from an inundation of Turks, stimulated commerce, enhanced the papal power, and gave a powerful impulse to European civilization. Minor crusades were directed against the Albigenses, Hussites, and other European heretics; the name was even bestowed on papal wars in Italy.

Crusenstolpe, MAGNUS JAKOB, 1795–1865. Swedish historical and political novelist, imprisoned 1838–41 for alleged seditious writings. *The Moor*, 1840–44; *Carl Johan*, 1845–46; *Carl XIII.*, 1861.

Crush. In coal-mining, sinking of the roof, caused by weakness of the supporting pillars.

Crusher. Machine to break larger lumps of ore or coal.

Crushing Strength. Force per sq. inch necessary, in crystalline material, to disintegrate it by pressure; in ductile material to shorten and deform the specimen by 5 to 10 per cent in a short length. Usual values in lbs. per sq. inch: Pinewood, 5,400; oak, 6,500; brick, 2,000; cast-iron, 85,000 to 125,000; wrought iron, 33,000 to 36,000; steel, 150,000 to 330,000.

Crusoe, ROBINSON. Novel by De Foe, 1719; the idea was taken from the life of ALEXANDER SELKIRK (q.v.).

Crustacea, or NEOCARIDA. Aquatic Arthropods, breathing by gills. They have two pairs of antennæ, several pairs of legs on the thorax, and usually also on the abdomen. The great divisions are: *Entomostraca*, *Malacostraca*, and *Gigantostraca*. Another method of classification places the last with *Arachnoida*, as the tracheate section of *Acerata*, the *Crustacea* forming the branchiate section. See CERATA.

Crustaceous. Forming a crust, or hard and somewhat brittle layer, as the thallus of certain Lichens and Algæ.

Cruveilhier, JEAN, 1791–1874. Prof. Montpellier 1824, Paris 1836. *Pathological Anatomy*, 1828–40.

Cruz, RAMON DE LA, ab. 1731–1784. Spanish dramatist.

Cryohydrates. When solutions of salts are cooled below 0° C. they deposit either ice or crystals of the salt; if these be removed, at a certain temperature, the whole mass will solidify. Substances which act in this way are called cryohydrates.

Cryolite. $Na_6Al_2F_{12}$ or $(6NaF+Al_2F_6)$. Aluminium and sodium fluoride, found in Greenland, and used in the manufacture of soda, in making porcelain glass, and as a source of aluminium.

Cryophorus. Instrument contrived by Wollaston, in which water may be frozen by its own evaporation. It consists of a glass tube bent twice at right angles and having a bulb at each end. It contains enough water to partly fill one of the bulbs; the rest of the space is occupied by water vapor only. If the empty bulb be placed in a freezing mixture, the vapor within is condensed, and the water in the other bulb evaporates so rapidly that it freezes.

Cryophorus.

Crypt. Vault beneath a church, as in St. Peter's, Rome, St. Bénigne, Dijon, and the Glasgow cathedral; usually under the choir, much used till ab. 1300 for sepulture.

Crypto Calvinists. Lutherans of Calvinistic tendencies, especially ab. 1570.—Applied to the Missouri Lutherans for defending the doctrine of unconditional election.

Cryptocarpæ. See HYDROMEDUSÆ.

Cryptocrystalline. Rocks of which no magnifying power employed on thin sections discloses the constituent minerals; while the whole mass, being composed of doubly refracting particles, has evidently a crystalline texture.

Cryptogamia. Flowerless plants, those in which the processes of reproduction were formerly supposed to be obscure. The term is now nearly obsolete, the plants included under it being divided among the PTERIDOPHYTA, BRYOPHYTA, THALLOPHYTA, and PROTOPHYTA (q.v.).

Cryptography. Art of secret writing, long and widely used in diplomacy; also telegraphing or signaling in cipher.

Cryptopentamera. See TETRAMERA.

Cryptoraphideæ. Order of *Diatomaceæ*, comprising the circular, triangular, and irregular forms.

Cryptotetramera. See TRIMERA.

Crypturi. See TINAMOUS.

Crystal Cells. Cells containing crystals of mineral matter, generally oxalate of lime, found in the soft parts of many plants; known also as Lithocysts.

Crystalline Cones. Conical lenses beneath the corneal facets of the compound eye.

Crystalline Lens. Transparent biconvex body in the eye, behind the iris, which assists in focusing the light rays which enter the eye.

Crystalline Rocks. Rocks having a more or less crystalline structure. Often due to chemical precipitation from water, as calcareous rocks, or consolidation from igneous fusion, such as lavas.

Crystalline Schists. Crystalline rocks in which the crystalline granules are arranged in a more or less parallel

manner. Occur where the strata surrounding are greatly compressed, crushed, and pressed into irregular folds. From this it is believed that pressure and the heat caused by earth movements were the causes of formation. See SCHISTS.

Crystalline Stylet. Clear body, lodged in a sac, connected with the stomach of certain Lamellibranchs.

Crystallite. Microscopically small crystal.

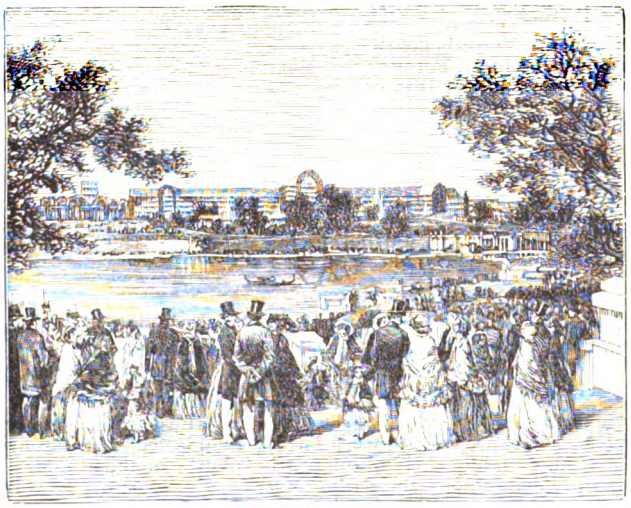
Crystallization of Metal by Shock. It is held by many that a bar of wrought-iron or steel which when new had shown great strength and toughness may become so altered as to molecular structure by tensional jerks, or compressive or transverse jars, that it will be no longer able to resist its original strain. When such a bar (which originally showed the fibrous appearance at the fracture which accompanies tough iron) is suddenly broken in service, it is apt to exhibit a crystalline appearance at the break. The adherents of the first theory would thereupon conclude that it had broken because it had changed from fibrous to crystalline. The difficulties of this theory are, in brief, (1) there is no such thing as a fibrous structure in iron; (2) the change from one structure to another cannot occur in the cold solid; (3) the same bar may be made to show both types of fracture by varying the method of the break. A better theory explains these phenomena as the effect of combination with the metal of the uncombined carbon present. This will occur under jerk, jar, or shock, and, hardening the metal, renders it less able to stand sudden loads, and opens its grain, or makes it more coarsely crystalline.

Crystallography. Science that discusses the forms and physical properties of crystals.

Crystalloids. Crystallizable soluble substances, as urea and chloride of sodium, which will diffuse through a vegetable or animal membrane; opposite of colloids.

Crystallomancy. Divination by crystals or gems; formerly much resorted to.

Crystal Palace. 1. At Sydenham, near London, 1851, for the World's Fair, mainly of iron and glass, covering 21 acres,



Crystal Palace, Sydenham.

rebuilt 1854; now used for popular entertainments. 2. In N.Y. City, for a like purpose, in 1853–58.

Crystals. Considered with reference to their optical properties, there are three classes: 1. Single refracting crystals, or those belonging to the cubical system. 2. Uniaxial, double refracting, belonging to the rhombohedral or to the tetrahedral system. 3. Biaxial, with two axes of double refraction. In this case both rays are extraordinary rays. In many crystals of the second class, such as Iceland spar, mica, and tourmaline, the index of refraction for the ordinary is greater than that for the extraordinary ray; such crystals are called "negative" or "repulsive." The reverse is true in some others, as in quartz, ice, zircon; these are "positive" or "attractive."

Ctenacanthus. Fin spines of moderate or large size with serrate edges. They are exclusively Palæozoic and widely distributed through the Carboniferous of Europe and America, and are found sparingly in the Devonian. The sharks bearing these spines must sometimes have been of formidable size.

Ctenidia. 1. Comb-like swimming plates of *Ctenophora*, also termed Ctenophores. 2. Primitive gill of Mollusks, modified in the Clams and Mussels into the plate-like gills by the looping back of the lateral processes of the original Ctenidium.

Ctenobranchia (CTENIDIOBRANCHIA). See TECTIBRANCHIA. In this group of Opisthobranchs, the ctenidia function as gills; there is a delicate shell present, sometimes inclosed by a special reflection of the mantle. Epipodia are often present. Examples are the Sea-hares (*Aplysia*) and *Bulla*. The former is a large sea slug of a greenish color, which secretes a vast mass of colored mucous when disturbed.

Ctenobranchiata (PECTINOBRANCHIATA, ANISOBRANCHIATA). Sub-order of *Gastropoda*, having a large pectinate gill on the left side, and a rudimentary gill or olfactory organ. A spiral shell is usually present; most are carnivorous and possess a proboscis. A male intromittent organ is present. The group has these divisions: *Rhipidoglossa*, *Ptenoglossa*, *Rhachiglossa*, *Toxoglossa*, and *Tænioglossa*. These, with *Zeugobranchia*, are grouped under the sections HOLOCHLAMYDA and SIPHONOCHLAMYDA.

Ctenocyst. "Ear" (otocyst) of Ctenophores, situated at the aboral pole.

Ctenoid. Fish-scales having the edges toothed, usually found in fishes with some bony rays to the fins, as the Perch.

Ctenophora (CILIOGRADA). Medusa-like, spherical, cylindrical, or band-shaped organisms, with eight meridional rows of vibratile plates, formed of fused cilia. They often have two lateral tentacles, which can be retracted into pouches. They have a gastric cavity, and branched radiating canals, arranged with biradial symmetry. The families are *Cydippidæ*, *Cestidæ*, *Lobatæ*, and *Beroidæ*. The first three constitute the group *Sthenostomata*, and the last the *Eurystomata*.

Ctenophoral Canals. Meridional tubes beneath the swimming plates (ctenidia) of *Ctenophora*.

Ctenostomata. *Gymnolæmata* with the cell-orifice terminal, with a circle of spines that close it, as an operculum, when the polypid is retracted. Zoöids, differentiated into root filaments and stems, occur; *e.g.*, *Vesicularia*.

Ctesias. Greek historian; physician at the court of Persia 415–398 B.C. His *Persika* exists only in fragments and an abridgment by Photius.

Ctesibius, ab. 135 B.C. Greek of Alexandria, inventor of the clepsydra.

Ctesiphon. City on the Tigris, once capital of Parthia; taken by Romans 115, destroyed by Arabs 637.

Ctesiphon. Athenian prosecuted by Æschines for proposing in the Assembly to give a crown of gold to Demosthenes, who defended him in the oration *De Corona*.

Cuba. Largest island of the West Indies. Its w. end is between Florida and Yucatan; it stretches e. 780 m., with an average breadth of 50 to ab. 60 m.; area 43,319 sq. m. It is traversed by a range of mountains, highest and broadest at the e. end, where one peak is 7,700 ft. high. It is fertile, producing sugar, tobacco and fruits. The capital is Havana, on the north shore. Cuba was discovered by Columbus Oct. 1492, settled 1511–15, taken by England 1762, and ceded back 1763 to Spain, which has since governed it by Captains-General. The U. S. proposed to buy it 1848. Native discontent with foreign rule has caused many risings, the last 1895. Slavery was abolished 1886. Pop. ab. 1,525,000, nearly one-third colored.

Cubature. To determine the expression for the volume of a solid. For a solid of revolution the general expression is $V = \int \pi y^2 dx$ or $\int \pi x^2 dy$, as the axis of revolution is the axis of x or of y. The equation of the generating curve will reduce these expressions to functions of one variable, which integrated will give the general measure of volume.

Cubebs. Berries of a piperaceous plant, *Cubeba officinalis*, used to increase the flow of urine, and as an expectorant.

Cubic. 1. Algebraic expression of the third degree, involving two or more variables. 2. Measurements whose unit is a cube.

Cubic Equation. One involving the third power of the unknown or variable quantity, and none higher.

Cubical Parabola. Algebraic curve of the third order. General equation: $y = ax^3 + bx^2 + cx + d$. Rectangular equation with origin at the vertex of the curve: $y = ax^3$. It is used to construct the roots of a cubic equation of the form: $x^3 + a^2x - b^3 = 0$.

Cubit. Hebrew measure of length, held to be the distance from elbow to end of middle finger; therefore of varying length, but usually 18 inches.

Cubitus. Third rib or nervure of an insect's wing, counting from the anterior margin.

Cubomedusæ, or CUBOSTOMEÆ. Order of acraspedote

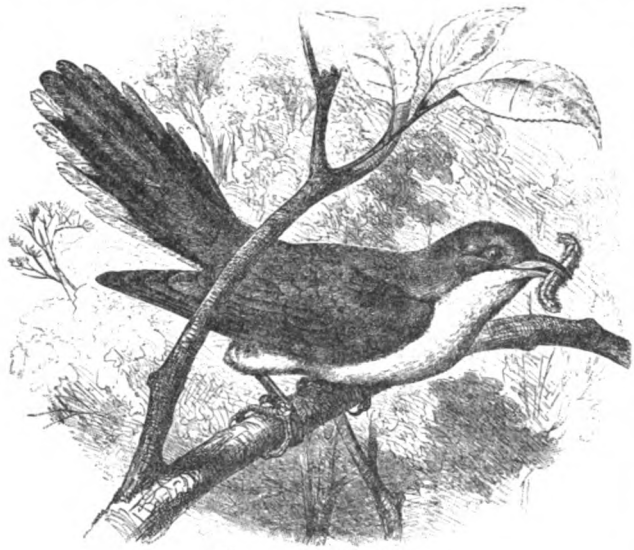
Jellyfish, having four per-radial sensory tentacles and four pairs of leaf-like reproductive organs, attached by one edge to the inter-radial septa on the subumbrellar wall, and projecting freely into the four broad per-radial pouches of the stomach; *e.g.*, *Charybdea*. The group is also termed MARSUPIALIDA (q.v.).

Cuckoo-Flower. *Cardamine pratensis.* Purple-flowered marsh herb of the natural family *Cruciferæ*, native of the colder parts of the n. hemisphere.

Cuckoos. See CUCULIDÆ.

Cuculi (COCCYGES, COCCYGOMORPHÆ). Sub-order of scansorial birds, including three sections: *Cuculidæ* (Cuckoos), *Alcedinoideæ* (Kingfisher, Bee-eater, Horn-bill, Hoopoe), and *Trogonidæ* (Trogons).

Cuculidæ (CUCKOOS). Group of Scansores, having a gently-curved, deeply-cleft beak, long-pointed wings, and wedge-shaped, pointed tail. The outer toe can be directed forward as well as backward. Peculiar group of birds, noted among other things for their voracity, their eating hairy caterpillars, their



Coccygus americanus.

mimicry of stronger birds of their locality, such as hawks, and for the mode of laying and hatching their eggs. The Old World cuckoos are especially marked by the habit of leaving their eggs to be hatched by other birds. The common European cuckoo (*Cuculus canorus*) is polyandrous, the female seeking several rather indifferent males; her eggs are laid about one per week to the extent of five, each in a different nest of insectivorous birds. The egg resembles in color the others, but is larger, and the young fledgling monopolizes the care of the foster parents. The spotted cuckoo of n. Europe lays four eggs in a nest, usually that of a crow. A small S. African cuckoo, size of a sparrow, is brilliantly colored. Australia has the large channel billed cuckoo, with its immense beak. American cuckoos hatch their own eggs, though they are laid at long intervals and so develop serially. The Road-runner or Chapparal cock of the desert plateaus of w. U. S. feeds mainly on grasshoppers. West Indies and adjacent U. S. has the Ani, with high bill, and peculiar in that several females unite in building one nest, where all co-operate in hatching their eggs.

Cucullate. Leaves or other flat structures which are rolled together at the sides or apex; hood-like.

Cucumber. *Cucumis sativus.* Trailing or partially-climbing vine of the Gourd family, probably native of w. Asia, cultivated from prehistoric times for its edible fruit.

Cucumber, SQUIRTING. *Ecballium elaterium.* Trailing vine of the Cucumber family, native of s. Europe. The fruit, when ripe, ejects its contents with force.

Cucumber Beetles. *Diabrotica vittata.* Yellow beetle, ¼ in. long, has three black stripes on back, feeds also on squash, melons, etc. Lays eggs at roots of plant. *D. 12-punctata* has twelve spots on back in place of the stripes. The larvæ feed on the roots, the beetle feeds on the stem and leaves. Dust with tobacco freely as plants are coming up, or protect with a small tent. Arsenites have no effect.

Cucumber-Root, INDIAN. *Medeola virginica.* Woodland plant of the Lily family, native of e. N. America. The root-stock tastes like cucumbers.

Cucumber-Tree. *Magnolia acuminata.* Large tree, with fruit bearing a remote resemblance to a cucumber, native of the s. e. U. S.

Cucurbitaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledons*, comprising 86 genera and ab. 630 species, distributed throughout the warm parts of the globe, especially the tropics; commonly called the Gourd family.

Cudbear. *Lecanora tartarea.* Crustaceous lichen, yielding a purple dye-stuff, growing on rocks and stones in the n. hemisphere.

Cuddalore. Town of s. e. Hindustan, 16 m. s. of Pondicherry; taken by the English 1681, by the French 1758, restored 1785. Pop. ab. 46,000.

Cudlip, MRS. ANNIE HALL (THOMAS), b. 1838, m. 1867. English novelist, author of some 50 books. *Denis Donne*, 1864; *Dower House*, 1868.

Cudweed. Various species of *Gnaphalium*, a genus of the natural family *Compositæ*, of wide geographical distribution.

Cudworth, RALPH, 1617–1688. Cambridge Platonist; celebrated for an attempt at the refutation of atheism which stated the argument for it so fairly and forcibly that he was charged with making his answer weaker than the attack. Works: *True Intellectual System of the Universe*, 1678; *Eternal and Immutable Morality*, pub. 1731.

Cuenca. Moorish city of Spain, 85 m. e. s.e. of Madrid; taken by Carlists July 14, 1874. Pop. ab. 8,000.

Cueva, BALTAZAR DE LA, COUNT OF CASTELLAR, 1626–1686. Councilor of the Indies. As Viceroy of Peru, 1674–78, he was an active and humane reformer.

Cufic, or KUFIC. Old form of Arabic, used in documents ab. 500–950, and somewhat later on Mohammedan coins; named from Cufa on the Euphrates.

Cui, CESAR ANTONOVITCH, b. 1835. Russian military professor, best known as a composer and writer on music. He has written several operas, many songs, and pianoforte pieces, and a book in French, *La Musique en Russie.*

Cuirass. Musket-proof body armor, formerly much worn. It consisted of iron or steel breast and back plates, joined together by straps.

Cuirassiers. Heavy cavalry in French, German and Russian armies, wearing the cuirass and helmet.

Cuitlahuatzin, ab. 1475–1520. Brother and successor of Montezuma, active in resisting Cortés.

Cujas, JACQUES DE, 1522–1590. French expositor of Roman law; prof. at Bourges 1577. *Works*, 10 vols., 1658.

Culcit. *Balantium culcita.* Large fern of Madeira and the Azores, its creeping root-stock covered with long, brown, silky hairs; collected and used for stuffing cushions, etc.

Culdees. Missionary monks established by ST. COLUMBA (q.v.) ab. 570 on Iona and throughout Caledonia.

Cul-de-Sac. Military position hemmed in on all sides, and from which the only exit is held by the enemy.

Italian Cuirass and Helmet.

Culin, ROBERT STEWART, b. 1858. Director of Museums of Archæology and Paleontology, Univ. Pa., from 1892. *Religious Ceremonies of the Chinese of U. S.*, 1887; *Korean Games*, 1895.

Culinary Paradox. Water boiling at so low a temperature as not to cook food; brought about by reducing the pressure on the surface of the water.

Cullen, PAUL, D.D., 1803–1878. Abp. of Armagh 1850, and of Dublin 1852; Cardinal 1866; active Ultramontane, aggressive, and hostile to Fenianism and to mixed schools.

Cullen, WILLIAM, M.D., 1710–1790. Prof. Edinburgh from 1755. *Practice of Physic*, 1777; *Institutions of Medicine*, 1777; *Nosology*, 1785; *Materia Medica*, 1789.

Culloden. Moor e. of Inverness, where the Duke of Cumberland defeated Charles Edward, the Pretender, April 16, 1746.

Cullom, SHELBY MOORE, b. 1829. M.C. 1865–71; Gov. of Ill. 1877–83; U. S. Senator 1883–95; author of the Interstate Commerce Law, 1886.

Cullum, GEORGE W., U. S. A., 1809–1892. Author of *Military Bridges*, 1849–63; *Biog. Register of Officers and Graduates of U. S. Military Academy*, 1850–90.

Culm. Stem of the Grass and Sedge families; herbaceous, but in the Bamboo is arboreous or arborescent.

Culm. In England, anthracite coal; in the U. S., fine coal, slack, or waste of the mines.

Culmen. Top ridge of beak of birds.

Culmicolous. Plants growing upon the culms of grasses or sedges.

Culmination. Passage of a heavenly body over the meridian of a place. The upper culmination when it crosses that part of the meridian containing the observer's zenith, the lower when it crosses that part containing his nadir. If the polar distance of the star does not exceed the latitude of the place both culminations may be observed.

Cultirostral. Having the beak shaped like a colter of plowshare, as in Herons.

Cultirostres. See HERODII.

Cultivators. Tillage implements whose action on the soil lies between that of the plow and harrow. They stir the soil to a greater depth than harrows; the teeth are larger and less numerous, and some of them perform more or less of the turning action of the plow upon the soil. They also remove weeds.

Cultrate. Shaped like a pruning-knife.

Cultures. Various bodies, soups, potato, gelatin, etc., upon which micro-organisms are artificially cultivated; the colonies themselves and the products resulting from them.

Culverin. Long 18 lb. cannon in use ab. 1350–1550.

Culvers-Root. *Leptandra virginica.* Tall perennial herb of the natural family *Scrophulariaceæ*, native of e. N. America, known also as Culver's Physic.

Culvert. Passage to carry water underneath a street or embankment; usually built of stone, the upper part being arched when the diameter is more than 8 feet. For shorter spans box-culverts of stone or timber are used, and for a small amount of water iron pipes are employed.

Culverwell, NATHANAEL, d. ab. 1650. Cambridge Platonist. *Light of Nature*, 1652.

Cumacea. Thoracostraca, with a small cephalothoracic shield, four or five thoracic segments being free. There are two pairs of maxillipeds, and six pairs of legs, some of which are biramous. The abdomen has six segments, that bear two to five pairs of swimming feet, and also the caudal swimmerets and telson.

Cumæ. Earliest Greek settlement in Italy, on coast of Campania; residence of the Sybil; taken by Samnites 417 B.C.; Roman colony 338 B.C.; taken from Goths by Byzantines 552; finally destroyed ab. 1250.

Cumæan Sibyl. See SIBYL.

Cumaric Acid. $HO.C_6H_4CH{:}CH.COOH$. o-Oxycinnamic acid; long needles, soluble in water; present in the *Melilotus*, but usually prepared by the action of sodium upon its anhydride, cumarin.

Cumarin. $C_9H_6O_2$. Mpt. 67° C. Anhydride of cumaric acid; found in the Tonka bean and other plants: glancing prisms, soluble in water and alcohol.

Cumberland. City of Allegany co., Md., on n. bank of the Potomac, in w. part of the State, in a region of bituminous coal, the mining and shipping of which is the principal industry. Pop., 1890, 12,729.

Cumberland, RICHARD, D.D., 1632–1718. Bp. of Peterborough 1691. *Laws of Nature*, 1672, a Latin reply to Hobbes, Eng. trs. 1692, 1750. Fr. 1744; *Jewish Weights and Measures*, 1685; *First Planting of Nations*, 1724.—His great-grandson, RICHARD, 1732–1811, a dramatist, was called by Goldsmith "the Terence of England, the mender of hearts." *The Observer*, 1785–86; *Memoirs*, 1806.

Cumberland, WILLIAM AUGUSTUS, DUKE OF, 1721–1765. Son of George II.; defeated by Saxe at Fontenoy 1745; victorious over the Pretender at Culloden 1746.

Cumberland Disease. Anthrax of cattle.

Cumberland Gap. Pass in Cumberland Mountains at the point where Va., Ky., and Tenn. meet; fortified and held by both sides 1861–65.

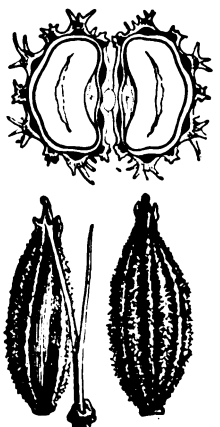
Cumberland or **Alleghany Plateau.** Westernmost member of the Appalachian Mountain system. It extends from N.Y. s. to Ala., with a clearly-defined escarpment to the s. e., and sloping gently n. w. The surface is deeply eroded in many places, so as to leave only a skeleton of the plateau remaining.

Cumberland Presbyterian Church. Organized in Tenn. 1810. It combines Presbyterian polity with semi-Arminian doctrine and methods. Communicants, 165,472; congregations, 2,844; ministers, 1,875; presbyteries, 121.

Cumberland River. In Ky. and Tenn.; left hand branch of the Ohio, heading in the slopes of the Cumberland plateau in e. Ky. Length ab. 650 m.; drainage area 18,573 sq. m. It is navigable during half the year to Port Burnside.

Cumene, or **Cumol.** $C_6H_5.CH{:}(CH_3)_2$. Bpt. 152° C. Isopropyl benzene; liquid aromatic hydrocarbon, prepared from benzene and isopropyl bromide.

Cummin. *Cuminum cyminum.* Herb of the Carrot family, long cultivated for its aromatic seeds, native of Europe or w. Asia.



Cuminum cyminum.

Cumming, JOHN, D.D., 1807–1881. Scottish pastor in London 1832–79; noted as an expounder of prophecy and assailant of Rome; author of many books of wide circulation.

Cumming, ROUALEYN GEORGE GORDON, 1820–1866. Scottish officer in S. Africa. *Five Years' Lion-Hunting*, 1849. —His sister, CONSTANCE FREDERIKA GORDON, b. 1837, pub. books of travel.

Cummins, GEORGE DAVID, D.D., 1822–1876. Assistant Bp. of Ky. 1866; founder of the Reformed Episcopal Ch. 1873.

Cummins, MARIA SUSANNA, 1827–1866. American novelist. Her *Lamplighter*, 1854, had a great vogue. *Mabel Vaughan*, 1857; *El Fureidis*, 1860; *Haunted Hearts*, 1864.

Cumol. See CUMENE.

Cumquat. Shrubs of the genus *Eriobotra*, natural family *Rosaceæ*, natives of Asia.

Cumulus. Cloud in which the base is flat and the top more or less piled up; often of immense size, as in violent hail storms.

Cunanthidæ. Family of *Narcomedusæ*, having wide pocket-like radial canals that branch out into blind sacs. The auricular tentacles have otoporps at their bases.

Cunard, SIR SAMUEL, 1787–1865. Founder of the Cunard line of vessels 1838–40: Baronet 1859. Iron steamships were introduced 1855, and the screw 1862.

Cunaxa. Town on the Euphrates, ab. 60 m. n.w. of Babylon. Here Cyrus the younger fought his brother Artaxerxes and was slain 401 B.C.

Cuneate. Leaves or other organs which are wedge-shaped in outline.

Cuneiform Writing. System which originated in Chaldea and spread to Assyria, Persia, and other countries and races bordering on the Tigris-Euphrates Valley. It was conse-

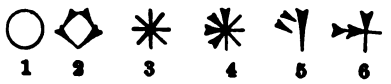
Persian.

Scythic.

Babylonian.

quently used for several distinct languages. The characters best known and universally used in later times are made of

wedge-shaped lines, whence the name; but the oldest characters are made with straight lines. Clay was the material most used as a surface, and the use of this material perhaps explains the wedge shape of the lines, as resulting from the impressions of a stylus made for the purpose. The clay was subsequently baked. Small pillow-shaped tablets were used for contracts, letters, etc. Larger barrel-shaped clay cylinders, and also eight-sided bricks, were used for books and larger inscriptions. The most important literature in this writing is that of the Chaldeans and Assyrians, consisting of historic records, religious myths and traditions, invocations, prayers, and works on various branches of knowledge. The language of the most ancient Chaldeans (Accadians), is being deciphered by the aid of Assyrian dictionaries or word lists. Assyrian was again deciphered through Persian inscriptions repeating the same matter (see BEHISTUN) and by means of Hebrew and Arab, to which Assyrian is cognate. Thus the Persian cuneiform inscriptions were the ones first read, and these not until after 1830. The deciphering of the characters was begun by the German Grotefend in 1802, by a system of shrewd guesses as to names of certain Persian kings, like Darius and Xerxes, these guesses being based on the regular recurrence of the characters for these names and other known historic facts about the inscriptions. The characters are partly alphabetic, partly syllabic, and partly



1, sun, 3, star, drawn on papyrus; 2, 5, sun, 4, 6, star, pressed in clay.

ideographic. They were originally all pictorial, but, being made on clay, were necessarily simplified and conventionalized, so that the original form of many of them is uncertain. These studies have been pursued with most success by Hebrew scholars, on account of the affinities of Hebrew and Assyrian. The finest collection of cuneiform inscriptions in this country is in the Univ. Pa. Museum.

Cunette, or CUVETTE. Small open drain in the middle of a ditch to carry off surface water.

Cunha Barboza, JANUARIO DA, 1780–1846. Brazilian priest, journalist, and poet.

Cunha Mattos, RAYMUNDO JOSE DA, 1776–1839. Portuguese geographer and historian, in Brazil from 1817.

Cunliffe-Owen, SIR PHILIP, b. 1828. Director S. Kensington Museum.

Cunnersdorf. In Prussia; scene of defeat of Frederick II. by Austrians and Russians, Aug. 12, 1759.

Cunningham, ALLAN, 1784–1842. Scottish poet and romancer, living in London from 1810. *Tales of the Peasantry*, 1822; *Songs of Scotland*, 1825; *Lives of Painters*, 6 v., 1829–33; *Life of Sir D. Wilkie*, 1843.—His son, PETER, 1816–1869, wrote two books on London, 1849–51, and lives of W. Drummond, 1835, and Inigo Jones, 1848.

Cunningham, JOHN, D.D., LL.D., b. 1819. Minister of Crieff since 1845. *Ch. History of Scotland.*

Cunningham, JOHN WILLIAM, 1780–1861. English divine and poet; Vicar of Harrow, 1811. *World without Souls*, 1805; *Velvet Cushion*, 1814; *Morning Thoughts*, 1824–27.

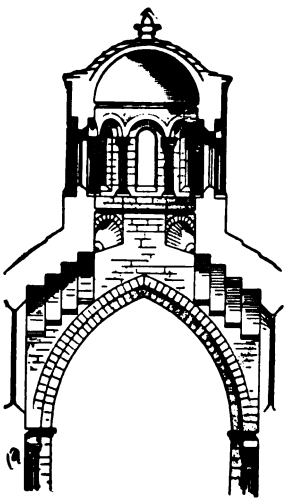
Cunningham, WILLIAM, D.D., 1805–1861. Prof. New Col., Edinburgh, 1843. *Theology of the Reformation*, 1862.

Cup and Ball. Game played with small wooden or ivory ball, fastened by a string to a stick having at one end a cup to fit the ball, and usually at the other a point on which the ball may be transfixed. The game is without significance in Europe. It is common among the Eskimo and the various Indian tribes of N. America. The former use a block of walrus ivory or a rabbit's skull, the latter being apparently the earlier form. The Sioux Indians play a similar game with a string of the phalangal bones of the deer. Among the Pueblo Indians and among the Penobscots a phallic significance is attributed to the two parts of the implement.

Cupid. See EROS.

Cup Leather. Backing to prevent leakage around pistons or plungers which have to withstand pressures of non-heated liquids. An annular ring of flexible leather is cut of such a size that when put to work it will lie against the side of the surface which it is to fit, and in the direction from which the liquid pressure comes. When the pressure is let on, it forces the flexible leather out against the surface which it is to pack, and the heavier the pressure the more closely does it fit. Where the pressures alternate as in a piston, there must be double leathers. The leather will not withstand great heat, and under excessive pressures cracks in the bend. It is much used for plungers of cranes and hydraulic presses, and for pumps.

Cupola. Hemispherical, spheroidal, or segmental dome, with a circular or polygonal ground-plan, supported by four massive ribs or plain walls. The Italian architects borrowed it from the Byzantines who produced the first known cupolas on pendentives, of which St. Sophia is the finest example.



Cupola.

Cupping. Method of drawing blood to the surface by means of small glasses from which the air is exhausted. When this alone is is done, it is known as Dry Cupping, but when the skin is scarified, as Wet.

Cup-Plant. *Silphium perfoliatum.* Large, coarse plant of the Composite family, native of the U. S.

Cupples, GEORGE, 1822–1891. Scottish nautical novelist, called by Prof. Masson "the English Jean Paul," and ranked by Clark Russell with R. H. Dana, Herman Melville, and Michael Scott as "four poets of the deep." *The Green Hand*, 1856; *Two Frigates*, 1859; *Hinchbridge Haunted*, 1859; *Cupples How, Mariner*, 1873.—His wife, ANN JANE, produced from 1867 some fifty novels. *Tappy's Chicks*, 1872.

Cuprammonium Compounds. Ammonium salts in which a portion of the hydrogen has been replaced by copper; *e.g.*, C. sulphate, $Cu<^{NH_3}_{NH_3}>SO_4$.

Cupreous. Copper-colored.

Cupric Carbonate. $Cu_2(OH)_2CO_3$. Voluminous blue precipitate, made by adding a carbonate to cupric sulphate.

Cupric Chloride. $CuCl_2.2H_2O$. Bright green crystals, soluble in water and alcohol; made by dissolving copper in hydrochloric acid; unites with NH_3 to form $CuCl_2.6NH_3$; dark blue in water solution.

Cupric Compounds. Those in which copper is bivalent, as in CuO, $CuSO_4$, $CuCl_2$.

Cupric Hydroxide. $Cu(OH)_2$. Made by treating a cupric salt with a soluble hydroxide. It is a heavy blue precipitate; when heated it becomes black, owing to the formation of cupric oxide, CuO.

Cupric Nitrate. $Cu(NO_3)_2$. Blue crystals, made by dissolving copper in nitric acid.

Cupric Oxide. CuO. Found native; made by heating the hydroxide or nitrate; used extensively in analytical operations as an oxidizing agent.

Cupric Sulphate. Blue Vitriol, Blue Stone, Copper Sulphate. $CuSO_4.5H_2O$. Found native in small quantities; made by dissolving cupricoxide in sulphuric acid; soluble in water and used in copper plating, in galvanic batteries, in the manufacture of blue and green pigments, and to kill the phylloxera.

Cupric Sulphide. CuS. Black powder, made by passing hydrogen sulphide into copper salt solutions; insoluble in dilute acids, except nitric.

Cuprite. Cu_2O. Red oxide of copper; mineral compound of copper and oxygen, containing 88.8 per cent copper; widely distributed and occurs in a variety of forms.

Cuprous Chloride. CuCl. White crystalline compound, soluble with difficulty in water, made by heating cupric chloride. It unites with ammonia to form the compound $CuCl.NH_3$.

Cuprous Compounds. Those in which copper is univalent, as Cu_2O, Cu_2Cl_2 or CuCl.

Cuprous Hydride. CuH. Yellow unstable solid, made by treating a solution of hypophosphorus acid with copper sulphate.

Cuprous Hydroxide. No compound of the formula CuOH is known, but if sodium hydroxide be added to a cuprous salt, a compound of the formula $4Cu_2O.H_2O$ is formed.

Cuprous Iodide. CuI. White powder, made by precipitating a cupric salt with an iodide.

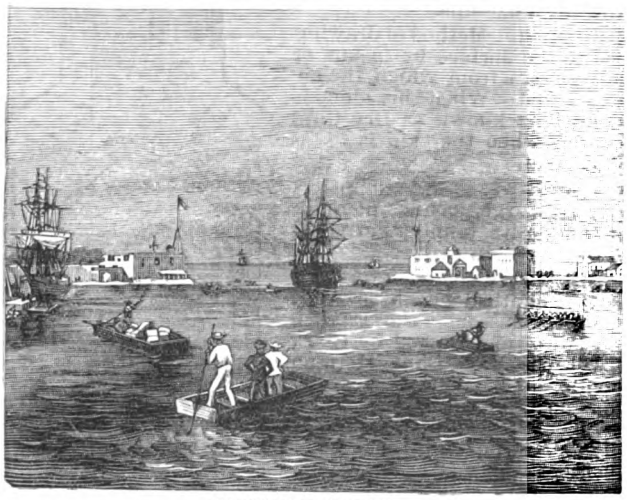
Cuprous Oxide. See CUPRITE.

Cupseed. *Calycocarpum lyoni.* High climbing vine of the Moonseed family, native of the s. U. S.

Cupule. Involucre surrounding the nut in plants of the Oak family (*Cupuliferæ*), as the cup of an acorn, the bur of a chestnut or beechnut.

Cupuliferæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledons*, comprising 10 genera and ab. 420 species, scattered through all parts of the globe, and especially numerous in the temperate regions of the n. hemisphere; commonly called the Oak family.

Curaçoa. Island n. of Venezuela; discovered 1499 and held by Spain; taken by the Dutch 1632, by the British 1807; ceded



The Harbor, Curaçoa.

back to the Netherlands 1814. Area 210 sq. m., or with Bonaire 305; pop., 1891, 26,245.

Curaçoa. Dutch liqueur, made from the peel of Curaçoa oranges; widely used.

Curara, or WOORALI. Vegetable resinous body, used in S. America as an arrow poison; obtained from plant Curari, and owes its properties to an alkaloid, Curarina, said to be antagonistic to Strychnia. Taken into the stomach it is without effect, but when introduced beneath the skin it rapidly proves fatal by paralyzing the muscles. It is used in medicine in the treatment of Lockjaw and Rabies.

Curate. One having cure of souls; now assistant minister, especially of an Anglican parish; commonly removable by incumbent or bishop.

Curb. Circular or polygonal frame, so constructed as to support the walls of a shaft or to carry a section of the shaft lining.

Curculio. See TETRAMERA.

Curcumin. $C_{14}H_{14}O_4$. Active principle of the yellow dye-stuff, turmeric, which is a ground root; sensitive to alkalies, which turn it brown.

Curd. Mass formed in the process of cheesemaking, from the time that the casein has been coagulated till the cheese is taken from the press.

Curetes. 1. Demigods of Cretan mythology. 2. Priests of the Cretan goddess Rhea, and of the Idæan Zeus.

Cureton, WILLIAM, D.D., LL.D., F.R.S., 1808–1864. Canon of Westminster, 1849. *Gospels in Syriac*, 1858.

Curfew. Bell rung at 8 P.M. in winter and at sunset in summer, as a warning to cover all fires. The custom existed in England from 1068, and prevailed throughout Europe.

Curia. 1. One of 30 sections into which Romulus is said to have divided the Roman people. 2. The Senate House, sometimes the Senate.

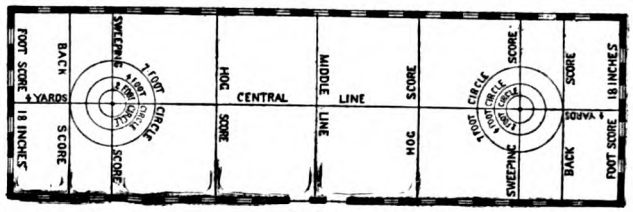
Curia Romana. Body of officials of the Roman see, forming, under the Pope, the administration of the R. C. Ch.

Curiatii. See HORATII.

Curlews. Snipe-like birds, one to two feet long, streaked and spotted on a cinnamon-colored background, with long, slender bills curved downward; those with a hind toe belong to the northern genus *Numenius*, of which five species in N. America. The hind toe is absent in the Red-billed Curlews of Central Asia, and in the Stone Curlew of Europe, also called Thick-kneed Bustard. Curlews are very shy, shore-loving birds, and are related closely to the tropical Stilts and Avocets, whose bills are respectively straight and curved upward.

Curling. Sport of Scottish origin or development, three centuries old, played with stones on ice like a game of sliding quoits. In 1838 the Grand Caledonian Club was formed. In 1878 the Rusholine Ice Rink at Manchester was constructed at a cost of £20,000, and the Southport Glaciarium a year later at a cost of £30,000. There are 500 clubs in Scotland, with a membership of 20,000, 33 in England, with a membership of 2,000, 100 in Ontario, with a membership of 4,000, and 40 in the U. S., with a membership of 1,000.

The game is played by two sides, of four players each, and each side with a captain. The appended diagram gives the lay-out of the rink. The principle of the game is similar to that of quoits, but the execution far more complicated and skillful, involving, as it does, the striking of one stone with another and thus knocking them into better or worse positions, as well as so placing the stones as to prevent molestation. The sweeping



Curling.

before the stone is also an added element. The stones are circular, from thirty-two to forty-four pounds in weight, not greater than thirty-six inches in circumference, smooth and polished, with metallic handles; or the stone may be an iron block of not over seventy pounds in weight. The player sends his stone as near the tee, that is, the center of the circle, as possible. He is then followed by a player of the opposite side. The player's side is allowed to sweep for the stone after it has passed the middle line until it reaches the tee, the adverse party after it has reached the tee. The terms of the match may either be, that the parties shall play for a specified time, or a game of a certain number of shots or heads. In a point game there are eight points at each of which each competitor plays four shots.

Curran, JOHN PHILPOT, 1750–1817. Irish lawyer, famous for eloquence and wit.

Currant. Shrubs of the genus *Ribes* of the Saxifrage family, natives of the n. hemisphere; cultivated for their fruits. *R. aureum* is the Missouri Currant, often planted for its showy yellow flowers.

Red Currant (*R. rubrum*).

Currant Insects. 1. The borer (imported from Europe) is larva of a slender dark blue moth having three yellow bands across body and a yellow collar, which lays eggs in young shoots in May. The larvæ are white grubs that bore into the wood and eat the pith. Burn the affected stems. 2. Currant "worm" (*Nematus ventricosus*, imported) is larva of a small four-winged fly, size of house-fly. The male fly is black with yellow spots; the female bright yellow with black head. In early summer the eggs are laid on under side of leaf veins and hatch in four days. After feeding eight days the larvæ burrow in ground and become adult flies in thirteen days. These worms are ¾ in. long, green with black spots. There are two broods, the second remaining in ground over winter. 3 *Cristiphora grossularia* is the native currant worm of similar habits. Use white hellebore, a teaspoonful to a gallon of water, sprayed on bushes as worms begin their attack. Repeat if necessary.

Currency. That which in any community passes readily from one person to another as a generally accepted medium of exchange.

Current, ELECTRIC. Transfer of electrification from a point of higher potential to a point of lower through some conducting medium. The practical unit of measure is the ampère, which is equal to one coulomb per second.

Current Meter. Shaft with vanes like a wind mill, which are turned by the impulse of a stream of water, the number of

turns per second indicating the velocity of the stream. In the modern forms the speed is indicated by a recording apparatus on shore, which is connected with the current meter by an electric wire. For a conduit or canal the current meter is the most accurate method of determining the velocity.

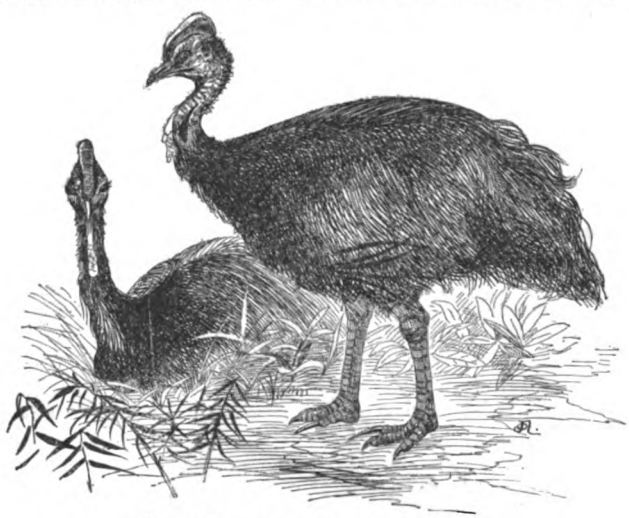
Currents, OCEANIC. The oceanic circulation is produced by the inequality of the sun's heat in different latitudes, and is modified by the earth's motion upon its axis. The equatorial waters, heated, and thereby expanded, flow poleward. The earth's rotation modifies the currents thus: a particle at the equator has a movement of translation around the earth's axis at the rate of ab. 1,000 miles an hour. In latitude 60° a particle moves but 500 m. an hour. A particle moving n. or s., therefore, constantly tends to maintain its rate of motion. Hence the oceanic currents move e. of n. in the n. hemisphere and e. of s. in the southern, as is seen in the cases of the Gulf Stream and the Japan current.

Currie, JAMES, 1756–1805. Scottish physician, editor of Burns, 1800.

Curry. Seasoning used by the natives of India; made of 22 spoonfuls turmeric, 8 of Cayenne pepper, 12 each of coriander seed, cummin seed, and dried cassia leaves. Among other ingredients are anise seed, allspice, fenugreek, garlic, ginger-poppy seed, asafœtida, almonds and cocoanuts.

Curry, DANIEL, D.D., LL.D., 1809–1847. Pres. Asbury Univ. 1854–57; ed. *Christian Advocate*, 1864–76, and *Methodist Review* from 1881. *New York*, 1853; *Book of Job*, 1888.

Cursores (STRUTHIONES, RUNNING-BIRDS, OSTRICHES). Order of *Ratitæ*, of considerable sized body, flat beaks, strong, two or three-toed, running feet. The bones are heavy, the wings reduced; there is no clavicle, and the plumage is scanty on the head, neck, legs, and abdomen. The feathers have a flexible shaft and lax vane. The two-toed Ostriches (*Struthionidæ*) inhabit the plains of Africa, are gregarious and polygamous. The three-toed Ostriches (*Rheidæ*) are American, The *Casuariidæ* (Emeu and Cassowary) have a high beak, a bony knob on the head, short neck, and three-toed feet. The term Cursores also designates the Grallatores, Rasores, and *Columbæ*, collectively.



Helmet Cassowary (*Casuarius galeatus*).

Cursoria. Orthopterous insects with running legs. The *Forficulidæ* and *Blattidæ* are included.

Cursorii. Birds with grallatory legs that have only three (sometimes two) toes, directed forward.

Curtain. Portion of the rampart connecting two adjacent bastions, or occupying the general direction of the exterior side.

Curtain Angle. Between curtain and flank of bastion.

Curtate Cycloid. One in which the moving point lies without the rolling circle determined by the equations:

$$x = r(\phi - m \sin \phi)$$

$$y = r(1 - m \cos \phi) \text{ when } m > 1.$$

Called also Trochoid.

Curtatone. In n. Italy, near Mantua; scene of defeat of Italians by Austrians under Radetsky, May 29, 1848.

Curtesy. Estate for life, created by the common law for the husband in lands seized by his wife in fee during coverture upon the live birth of issue which might inherit from the wife. It has been abolished or modified in many American States.

Curtin, ANDREW GREGG, b. 1815. Gov. of Pa. 1861–67, active in raising troops; Minister to Russia 1869–72; M. C. 1881–87.

Curtin, JEREMIAH, b. 1835. American linguist and traveler; tr. of Russian, Polish, and other novels.

Curtis, BENJAMIN ROBBINS, LL.D., 1809–1874. Judge U. S. Supreme Court 1851–57. *Reports*, 1854–57; *Digest of U. S. Decisions*, 1864; *Jurisdiction of U. S. Courts*, 1880.—His brother, GEORGE TICKNOR, 1812–1894, a lawyer in Boston and N. Y., pub. *Rights and Duties of Seamen*, 1841; *Law of Copyright*, 1847; *Law of Patents*, 1849; *Hist. U. S. Constitution*, 1855–58; *Life of Webster*, 1870; *Life of Buchanan*, 1883.

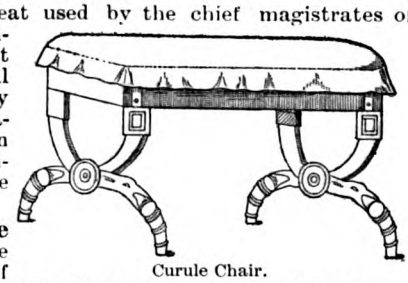
Curtis, GEORGE WILLIAM, LL.D., 1824–1892. American author, journalist, and reformer. *Nile Notes*, 1851; *Howadji in Syria*, 1852; *Lotus Eating*, 1852; *Potiphar Papers*, 1853; *Prue and I*, 1856; *Trumps*, 1862. Refusing public office, he exerted a wide and deep influence by his lectures and political speeches, by his *Easy Chair* papers in *Harper's Magazine* from 1853 and his editorials in *Harper's Weekly* from 1857, and as Pres. of the Civil Service Reform League. No American has been more eminent and useful at once in literature and in citizenship.

Curtis, WILLIAM, 1746–1799. English botanist; founder of the *Botanical Magazine*, 1786, continued after vol. xiv. to 1870 by J. Sims, S. Curtis, W. J. and J. D. Hooker. *Flora Londinensis*, 1774; *Lectures on Botany*, 1805.

Curtius, ERNST, b. 1814. German historian, prof. at Göttingen 1856, and Berlin 1865; tutor to the crown prince 1844–50; supt. of excavations at Olympia 1875–80. *Peloponnesus*, 1852; *Attic Studies*, 1864; *History of Greece*, tr. 1868–76.—His brother, GEORG, 1820–1885, prof. at Leipzig 1862, wrote much on Greek grammar and antiquities.

Curtius, METTUS. Legendary Roman hero, who closed an abyss in the forum by leaping into it ab. 362 B.C.

Curule Chair. Seat used by the chief magistrates of Rome, originally the emblem of kingly power. It was displayed on all great occasions, notably in the circus and theater. The illustration shows a bronze specimen preserved in the Naples Museum.



Curule Chair.

Curvature of the Earth. For moderate distances the effect of the curvature can be found by this rule: two-thirds of the square of the distance in miles gives the depression in feet. Thus, for 3 miles the deviation from a horizontal due to curvature is $\frac{2}{3} \times 3^2 = 6$ feet.

Curve. Line constantly changing its direction, distinguished from straight or broken line: in wider sense, path of a point moving according to any fixed law, thus including the straight line. Curves are classified (1) as plane or spatial, as the generating point is or is not limited to a plane; (2) according to the form of expression of the law governing their generation, as algebraic or transcendental; (3) according to the degree of the equation of the locus. Curves having rise in particular forms are classed from these precedent conditions; *e.g.*, conics, cycloids, etc.

Curved Fire. Trajectory of those projectiles fired at high angles, as mortars, as distinct from those fired at low angles, as rifled guns. With curved fire the advantage of ricochet is sacrificed for that of clearing an interposing cover and obtaining greater penetration in a vertical direction.

Curvirostral. Having curved beak.

Curwen, JOHN, 1816–1880. English musician, inventor of the Tonic Sol-fa system, to which he was devoted from 1841. *Grammar of Vocal Music*, 1843.

Curzon, GEORGE N., M.P., b. 1862. *Russia in Central Asia*, 1889; *Persia*, 1892; *Japan, Corea, China*, 1894.

Curzon, PAUL, 1820–1895. Fr. landscape and figure painter.

Cusa, NICOLAS DE, 1401–1464. German philosopher and theologian; cardinal 1448; Bp. of Brixen 1450. Leaving the scholastic tenets far behind, he anticipated some points of modern science and speculation. *De docta ignorantia; De Conjecturis.*

Cuscus. *Andropogon muricatus.* Fragrant grass, used in perfumery, native of India.

Cushing, CALEB, LL.D., 1800–1879. M. C. 1835–43; Justice Mass. Supreme Court 1852; U. S. Attorney-Gen. 1853–57; U. S. Counsel at Geneva Arbitration 1872; Minister to Spain 1873–77. *Spain*, 1833; *Life of W. H. Harrison*, 1840; *Treaty of Washington*, 1873.

Cushing, FRANK HAMILTON, b. 1857. American ethnologist. He has written much on the Zuni Indians.

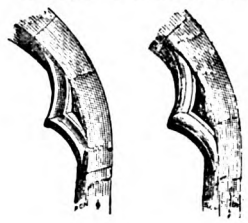
Cushing, LUTHER STEARNS, 1803–1856. Reporter Mass. Supreme Court. His *Manual of Parliamentary Practice*, 1844, is widely used. *Roman Law*, 1854.

Cushing, WILLIAM BARKER, U. S. N., 1842–1874. Lieut. 1864, Commander 1872. Of his feats of valor the most noted was the destruction of the ironclad *Albemarle* near Plymouth, N. C., Oct. 27, 1864.

Cushion Dance. Old English singing game in which the men and women alternately dance around with a cushion. The one holding it places it before one of the opposite sex, with whom he or she will then dance; prob. connected with marriage.

Cushman, CHARLOTTE SAUNDERS, 1816–1876. American actress. She began 1834 as a singer, appeared 1835 as *Lady Macbeth*, and won high esteem at home and in England, where she spent much of the time from 1844.

Cusp. Point in which two or more branches of a curve terminate and are tangent to each other; of the first order when the branches are on opposite sides of the rectilinear tangent; of the second order when on the same side.



Cusp. In Gothic architecture, the angle in which the foliations of tracery meet. also applied to the projection inward of the intrados of an arch producing a double curve. The arch is then said to be cusped, or cuspated.

Cuspidate. Leaves or other structures which taper to a sharp point.

Cusps.

Cusps. Pointed ends of the horns of the moon or of a planet when it has the crescent form.

Custard-Apple. *Anona reticulata.* Small tree of the natural family *Anonaceæ*, native of tropical America, where it is widely cultivated for its large, pulpy fruit; known as Sour-sop.

Custer, GEORGE ARMSTRONG, U. S. A., 1839–1876. General of cavalry, who served through the Civil War and on the frontier; killed with his whole command by Sioux on the Little Big Horn, Montana.—His widow, ELIZABETH (BACON), m. 1864, has pub. *Boots and Saddles*, 1885; *Tenting on the Plains*, 1887; *Following the Guidon*, 1891.

Custom, IN ECONOMICS. General understanding or habit in the community, determining prices and other economic conditions independently of any freedom of competition.

Customary Rent. Sum paid for the use of land when the conditions and amount are regulated by usage, not by competition.

Customs, IN ETHICS. Habitual actions of a community, analogous to laws, but not pressing the same moral claims to conformity; since laws can be deliberately changed when recognized to be bad, while customs can be destroyed only by the refusal of individuals to obey them.

Customs-Duties. Taxes levied on commodities imported into a country. They have formed an important source of public revenue in all civilized nations. A duty of two per cent was levied on all exports and imports at Athens. Duties were levied at Rome early in its history, and increased from time to time, till public discontent compelled their abrogation in the ports of Italy, though they were retained in the provinces. Julius Cæsar restored them at Rome, and Augustus increased the import duties and instituted new ones. Such duties have been levied in Great Britain from the earliest times. In 1846 England entered on a new era in her commercial policy, and repealed many of the duties. In 1826 the English tariff contained 432 enumerated articles; in 1863 only 52 were on the list. At present a duty is levied on less than 20 articles. The first tariff enacted by Congress, 1789, was mainly for the purpose of raising revenue, though the preamble announced that protection of domestic manufactures was one of the objects of the law; 17 tariff acts were passed between 1789 and 1816. In 1812 the duties were doubled. A fierce tariff controversy raged in 1832, resulting in a compromise law, having for its object the gradual reduction of duties until they reached a uniform level of twenty per cent ad valorem. In 1842, however, another act was passed raising the duties, which was superseded four years later. Since that time several acts have been passed of a highly-protective character, until the act of 1894.

Custozza. Village of n. Italy, scene of Italian defeat by the Austrians under Radetzky, July 23, 1848, and Archduke Albrecht, June 24, 1866.

Cutch. Brown dye-stuff, prepared by the evaporation of a liquor obtained by boiling the wood of certain species of *Acœra*, *Areca*, and *Uncaria*, called also catechu. It contains catechin and catechu tannic acid.

Cuthbert, ST., d. 687. Monk of Melrose, 651; Prior of Ripon, Melrose, and Lindisfarne, following the Scoto-Hibernian rule; main evangelizer of n. England. Adopting the Roman rite, he became Bp. of Lindisfarne 685, but soon returned to his cell.

Cuticle. Outer layer of the skin, made up of an interior layer of cells next to the corium or true skin, and several layers of dry cells, which are constantly being renewed from the inner layer.—In plants, filmy surface of the epidermis, sometimes called cutose.

Cutinization. Modification of the structure of vegetable cell-walls, yielding cutin, a substance which repels water, thus differing from cellulose and lignin, which absorb water. Also known as Suberification.

Cutler, MANASSEH, LL.D., 1742–1823. Pastor at Hamilton, Mass., from 1770; army chaplain; agent of the Ohio Co., and founder of Marietta, O., 1788; M.C. 1801–5. He was the first to classify New England plants.

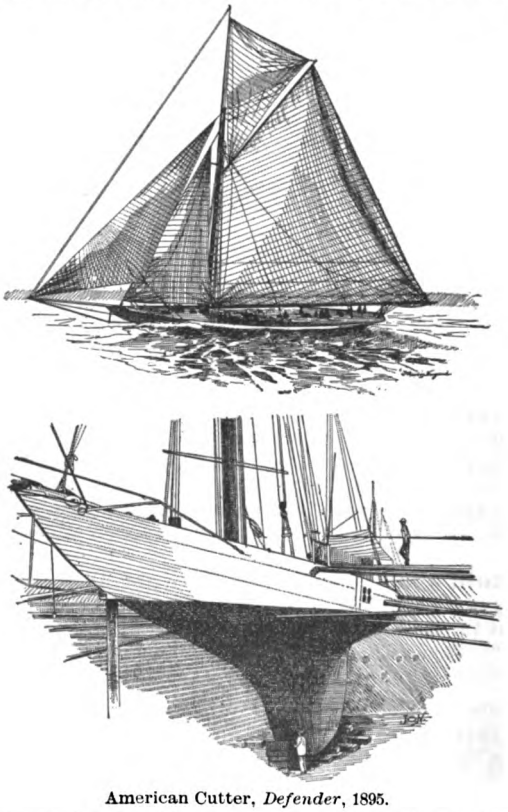
Cutleriaceæ. Order of green marine *Algæ.*

Cutlery. It originally embraced the manufacture of all cutting implements of whatever form and material, but now several kinds of edge-tools, saws and similar implements are regarded as distinct branches and a number of articles not strictly cutting implements are included. Shells and sharp stones were the most ancient cutting implements. Bronze was used by the Romans up to the beginning of the Christian era. Surgical instruments have been found at Pompeii, the bronze being tempered. Damascus was one of the first cities noted for its blades, especially swords. Toledo in Spain and Ferrara in Italy acquired a high reputation for cutlery during the Middle Ages. Later England outstripped them all in designs, elegance of finish and cheapness, Sheffield being most noted. In surgical instruments France excels. The men in the grinding department work in an atmosphere loaded with fine dust of silica and steel, inducing inflammation of the lungs, pleurisy and "grinders' asthma."

Cut-off. Point in the stroke of an engine piston at which the admission of live steam is stopped; expressed as a fraction, with the stroke as denominator. The degree of expansion of the steam is the reciprocal of the cut-off.

Cutose. See CUTICLE.

Cutter. Single-masted boat with topmast and running bowsprit carrying one jib, mainsail, gaff-topsail and fore staysail. This is the cutter rig, though the bowsprit is usually



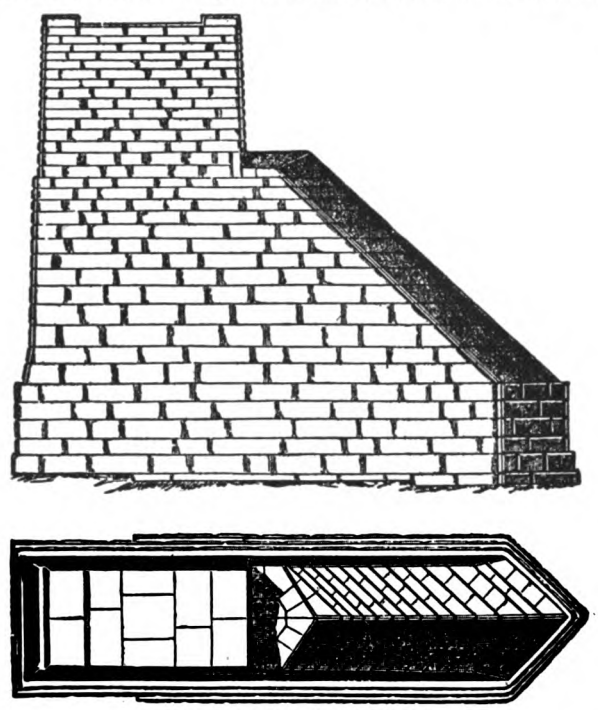
American Cutter, *Defender*, 1895.

fixed. Also, as auxiliary sails, balloon jibtopsail and spinnaker. It is now the favorite racing yacht; the America Cup being sailed for by boats of this rig, 1895.—The dimensions of the *Defender* are 23 ft. beam; ab. 20 ft. draught, 88.45 ft. water-line; 12,602 sq. ft. sail area.

Cuttle-Bone. Internal pen-shaped skeleton of the Cuttle fish.

Cuttle Fish. Mollusks of the class CEPHALOPODA (q.v.), especially order *Dibranchiata*. The larger species are popularly termed Devil-fish, the smaller are the Squids so much used for bait in Cod-fishing, etc. The "pen" is a horny secretion beneath the skin along the back. In the head the nervous system is protected by a cartilaginous cranium. Sepia ink was originally made from the contents of the ink-sac of Cuttle fishes.

Cutwater. Sharp nose of a pier which faces up stream and divides the current, while it also serves as an ice breaker.—



Pier, Victoria Bridge, Montreal.

In shipwrighting, the forward edge of the stem or prow of a vessel; that which divides the water right and left.

Cutworms. Larvæ of species of moths belonging to several genera, of which *Agrotis* furnishes the most common. The adults are somber grayish, or brownish, night-flying moths (millers) measuring an inch or two across expanded wings. Lay many eggs that hatch into greasy, greenish caterpillars (worms) that hide by day and gnaw the stems of young plants across at night. They can be killed by scattering fresh leaves soaked in Paris green. By encircling plant with a cylinder set into ground it is protected.

Cuvier, GEORGES LEOPOLD CHRETIEN FREDERIC DAGOBERT, BARON, 1769–1832. Father of Comparative Anatomy and Paleontology; prof. Paris 1795. He covered a very wide field, but studied principally the Mollusks, Fishes, and Fossil Vertebrates. The classification of Linnæus was based on isolated and analogical characters. C. based his on homological relations, as ascertained by the sum of all the structural facts; but as he did not take the facts of embryology into consideration, his system in its later developments at the hands of his successors has been modified. He divided the Invertebrates into Mollusks, Articulates, and Radiates. *Comparative Anatomy*, 1801–5; *Animal Kingdom*, 1817; *Fishes*, 1828.

Cuvillier-Fleury, ALFRED AUGUSTE, 1802–1887. Parisian journalist and critic. *Historical and Literary Studies*, 1854–59.

Cuyahoga Shale. Thick bed of shale, somewhat calcareous, occurring in n.e. Ohio and extending into Pa., where it becomes the Crawford Shale. It passes e. into the Shenango, Meadville, and Sharpsville Flags and their accompanying shales and limestones. Southward it holds the Logan Sandstone and Conglomerate of Licking co. and the Buena Vista stone of the Ohio R. See CARBONIFEROUS.

Cuyler, THEODORE LEDYARD, D.D., b. 1822. Presb. pastor in Brooklyn 1860–90. *Stray Arrows*, 1852; *Cedar Christian*, 1858; *Eagle's Nest*, 1890.

Cuyp, ALBERT, 1620–1691. Dutch painter, animal and landscape. A tonalist rather than a colorist, and most successful in painting the effects of sunlight.

Albert Cuyp.

Cuzco. City of Peru; ancient capital of the Incas, 11,400 ft. above the sea. It contained the great temple of the Sun, on a site now occupied by the cathedral, and other splendid buildings, besides the immense fort which remains. When entered by Pizarro 1533 it had 200,000 inhabitants. Pop. ab. 20,000, mostly Indians.

Cyanates. Salts of Cyanic Acid.

Cyanic Acid. CN.OH. Unstable acid, obtained by heating cyanuric acid; of pungent odor, polymerizing with great ease, passing into cyamelide with explosive violence.

Cyanic Ether. $OCN.C_2H_5$. Ethyl isocyanate. Bpt. 60° C. Colorless liquid of suffocating odor, prepared from ethyl iodide and potassium cyanate.

Cyanidæ. Family of *Semostomæ*, including Jelly Fishes having wide radial pockets and branched canals without a ring-canal.

Cyanides. Salts of hydrocyanic acid.

Cyanine. $C_{20}.H_{15}N_2I$. Produced from the substance made by the action of amyl iodide on chinoline and lepidine; sensitive to light, and used in photography; green crystals, insoluble in cold water; called chinoline blue and cyanine blue.

Cyanite. Al_2SiO_5. Aluminium silicate, found in schistose rocks; named from its blue color.

Cyanogen. NC.CN. Poisonous gas of odor like that of prussic acid; present in furnace gases, and probably formed from the combination of the nitrogen and carbon in the coal; also prepared by heating cyanide of mercury.

Cyanometer. Instrument constructed by Saussure for obtaining uniform comparable records of the blueness of the sky by comparison with a porcelain scale of blue tints. Saussure's original cyanometer had 51 tints, from white to black as extremes.

Cyanophyceæ. Class of *Algæ*, including all minute forms containing the peculiar bluish-green pigment called phycocyanin; known also as *Phycochromaceæ*.

Cyanophycin. Granular substance which replaces starch in the cells of the *Cyanophyceæ*.

Cyanosines. Commonly $C_{21}H_7Cl_2Br_4O_5Na$. Sodium salts of the tetrabromchlorfluoresceine methyl and ethyl ethers. They dye wool bluish red in an acid bath.

Cyanosis. Blueness of the skin due to insufficient oxygenation of the blood. It may be the result of suffocation, drowning, or of any cause which interferes with a sufficient supply of air. In infants it is often caused by abnormal connection of the venous system with the aorta, which allows the passage of unaerated blood (always of a dark blue color) into the arteries. This defect may continue through life and the individual always be of a dusky hue, especially after exercising.

Cyanuric Acid. $C_3N_3O_3H_3$. Prepared by heating urea; prisms, soluble in water. From it cyanic acid can be prepared by heating. See CYANIC ACID.

Cyatheaceæ. Order of Ferns, including many of the tropical, tree-like species.

Cyathiform. Hollow, cup-shaped structures.

Cyathophyllum. See RUGOSA.

Cyathozoöid. Ascidian which develops from the egg and gives rise to the Ascidiozoöids by budding.

Cyaxares. I. King of Media 633–593 B.C.—II. His grandson, son and successor of Astyages, 569–536 B.C.

Cybele. See RHEA.

Cycadaceæ. Natural family of flowering plants of the class *Gymnospermæ*, comprising 9 genera and ab. 83 species, natives of the tropics and adjoining regions of both hemispheres.

Cycads. Trees and shrubs of the natural order *Cycadaceæ*, native of warm regions. *Cycas revoluta* and some other species are cultivated in greenhouses; known also as Sago Palm.

a, Cycas Normanbyana; *b*, *c*, Cycas media.

Cyclades. Delos and neighboring islands, in Ægean Sea.

Cyclamen. Genus of herbs of the Primrose family, natives of Europe and Asia, bearing showy, nodding flowers, much cultivated for ornament.

Cyclanthaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Monocotyledons*, comprising 6 genera and ab. 35 species, all natives of tropical America.

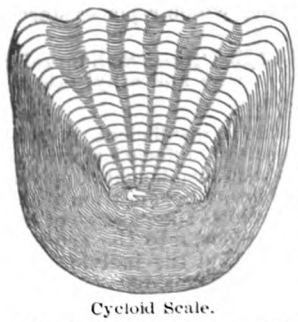
Cycle. Circle or period of time in which events or phenomena return in the same order. The solar cycle consists of 28 Julian years, after which the days of the week return to the same days of the month. The lunar or Metonic cycle is 19 lunar years and 7 intercalary months, after which new moons recur on the same dates as before. The cycle of Indictions has 15 years, that of Jupiter 60, and the cycle of eclipses comprises 223 lunations. The Paschal cycle, or time of keeping Easter, was first calculated for a period of 532 years by Victorius, 463.

Cyclic Poets. Earliest Greek poets who illustrated the cycle of legends of the Trojan War by a series of epics.

Cycling. See BICYCLE.

Cyclobranchiata (ZYGOBRANCHIA). Sub-order of *Prosobranchiata* (*Streptoneura*), including forms which have not lost the left side ctenidia, owing to secondary rotation of the visceral hump. These animals are dicœcious, but have no special generative ducts. The shell is cup-shaped, the gills are symmetrically arranged. Two kidneys are present. In the sub-division *Ctenidiobranchia* the gills are true ctenidia (as in *Haliotis*); in the group *Phyllidiobranchia* the ctenidia are rudimentary, and there are special pallial gills arranged in a circle around the base of the broad flat foot, as in *Patella*, the Limpet, which has a head with two tentacles and eyes, and a long spirally coiled tongue. Limpets are vegetable feeders.

Cycloid. Transcendental curve formed by the movement of a point in the plane of a circle which rolls upon a fixed line, especially when the point is on the circumference of the rolling circle, others being called Trochoids. To form the Common Cycloid the fixed line is straight. Its rectangular equation with fixed line as axis of X and origin at beginning of movement is: $X = r \operatorname{vers}^{-1}\frac{y}{r} - \sqrt{2ry - y^2}$ where r = radius of rolling circle. It is also determined by the equations $x = r(\phi - \sin\phi)$ and $y = r(1 - \cos\phi)$ where ϕ = the angle of rotation. The common cycloid is the path of quickest descent from one point to another not in the same vertical line, and the curve on which the vibrations of a pendulum are equal regardless of the arc traversed.—In mechanics, curve for the profiles of the gear teeth in a rack.


Cycloid Scale.

Cycloidei. Group of fishes whose scales are entire, with smooth edges, and whose fin-rays are soft as those of the salmon. See PHYSOSTOMI.

Cyclometopa (CANCROIDEA or ARCUATA). See CRABS.

Cyclomyaria. Group of *Thalliacea*, including *Doliolum*. The body is cask-shaped, the lips of the orifices are lobed. The muscles are present for the most part as closed rings. The digestive canal is not compressed into a nucleus, and the ovaries contain several eggs. Sperms and ova mature simultaneously. The eggs develop into larvæ with rudimentary, ventral stolon, and a proliferating dorsal stolon. In the dorsal stolon, two sorts of buds are produced. The lateral buds are nutritive, the median buds become free and produce the sexual forms by means of ventral stolons.

Cyclone. 1. Extensive storms at sea supposed, ab. 1848, to be due to air revolving in circles about a calm center. 2. Any horizontal atmospheric movement, gentle or rapid, general or local, on land or at sea, in which the wind blows spirally around and in toward a center. This air must necessarily be rising and overflowing, and must then flow away from the center, but this is a consequence and not a part of this definition of the word, as the word was still equally applicable to cases where the inflowing air descended instead of ascended, as in the upper cyclone that overlies an anticyclone. In both the preceding uses of the word the term applies only to the horizontal component of the motion of any fluid, and has been applied to the circulatory movement of bodies of water, both large and small. In the n. hemisphere the cyclonic motion is usually counter-clockwise; in the s. hemisphere it is clockwise. The central part of a cyclone has a low barometric pressure, a higher temperature, and usually cloud and rain. 3. In the most recent usage of meteorologists, the whole complex structure of the cyclonic storm, *i.e.*, the circulation, inflow, ascent, overflow, and outflow of air, with its attendant cloud, rain, and lightning. 4. In the U. S. since 1875, popularly, tornadoes of the Western States; but no such restricted usage is allowed in technical meteorology. 5. Also popularly, any severe storm or rather destructive wind. This misuse has not been adopted by the best authorities in meteorology. See STORMS, and WINDS.

Cycloneura. See HYDROMEDUSÆ.

Cyclonic. Like the movement of the air in cyclones. Formerly the word referred only to the circular component of the movement, but in modern meteorology it includes the idea of a spiral flow inward, whether the spiral rotation is positive or negative; *i.e.*, clockwise or counter-clockwise. Any fluid, as the water in a bowl, or the ocean.

Cyclonic Law. Law of circulation of the wind prevailing within the region of a cyclone. Originally the direction of the circulation, *i.e.*, clockwise in the s. or counter-clockwise in the n. hemisphere, was alone considered, but recent writers use the term to designate the whole system of winds flowing in below and out above.

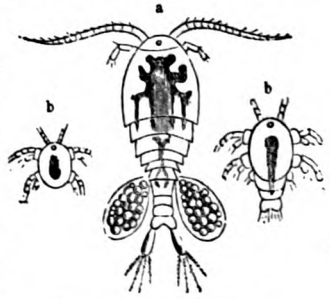
Cyclonograph. Form of dromoscope devised by Viscovich.

Cyclonoscope. Apparatus showing mechanically the location of a distant storm-center. These generally embody the simple principle that the storm-center makes a definite angle with the direction of the wind at a given place. This angle is 90° on the old circular theory, but is now known to vary with locality.

Cyclopean Walls. Ancient masonry, consisting of huge, irregular blocks of stone, fitting closely together, but unhewn and uncemented, such as may be seen at Mycenæ and Tiryns; built by several prehistoric races.

Cyclopes. According to Homer, a one-eyed race of giants in Sicily, who devoured human beings; according to Hesiod, 3 Titans who supplied Jupiter with thunderbolts; later, the assistants of Vulcan in forging armor for gods and heroes.

Cyclops (WATER-FLEA). Copepod with oval, five-jointed cephalo-thorax, slender four-jointed abdomen, ending in a fork bearing hairy bristles. The female carries two egg-sacs attached to the anterior abdominal segment. It swims by quick strokes of two pairs of antennæ. The eyes are fused into one pigment spot on the top of the head near the front. It is usually present in ordinary drinking water.



a, female; b, larva of Cyclops.

Cyclosis. Rotary movement of the fluid contents of vegetable cells, especially noticeable in those of certain aquatic plants.

Cyclospermous. Embryo of certain seeds, which is coiled arond the albumen.

Cyclospondyli. See SHARKS.

Cyclostomata OF MOLLUSCOIDEA. *Gymnolæmata*, the aper-

ture of whose cells (cystids) are wide, terminal, and without movable appendages. Most are fossil, and have been grouped into the *Articulata* (or *Radicellati*) and the *Inarticulata* (or *Incrustata*). The former, including only the *Crisiadæ*, are stalked forms; the latter include several families of *Polyzoa* that form incrusting colonies.

Cyclostomi (MONORHINA, MARSIPOBRANCHII). Group including vermiform, scaleless fishes, without paired fins, with persistent notochord and rudimentary neural arches, with a cartilaginous skeleton which supports the branchial basket and a skull which has two auditory vesicles. The mouth is circular, beset with teeth, is suctorial, and has no jaws. There are six or seven pairs of pouch-like gills. The nasal sac is unpaired; the two eyes are usually more or less sunk under the skin. Besides the heart there are pulsatile vascular trunks. Two families are included, the Hag-fishes (*Myxinoidæ*) and the Lampreys (*Petromyzontidæ*); orders, *Hyperotreta* and *Hyperoartia*.

Cyclostyle. Circular range of columns supporting a roof and not inclosing a building. When there is an inclosed building the circle of columns is called a peristyle.

Cydippidæ, or SACCATÆ. Ctenophores that are nearly spherical or cylindrical, and have eight regularly arranged meridional rows of swimming plates, and two tentacles. Each vibratile plate lies over a canal, which communicates at the equator with the gastric cavity, and ends blindly at the poles. At the aboral pole is a complicated otocyst.

Cylinder. Solid, bounded by a cylindrical and two parallel plane surfaces called bases; classified (1) according to the character of the cylindrical surface; (2) as right or oblique, as the elements of the cylindrical surface form right or oblique angles with the basal planes.—In steam engine practice, the hollow cylinder has a piston fitting its bore, and the expansive force of steam moves the piston to and fro, and performs work. Engine cylinders are always of cast-iron. The largest engine cylinders are or have been of the following dimensions:

Beam Engine, Stmr. "Rhode Island," P. & S. SS. Co.,	90in. x 14 feet.
" " " "Pilgrim," F. R. SS. Co.,	110in. x 14 feet.
" " " "Puritan," F. R. SS. Co.,	110in. x 14 feet.
" " Cornish, Friedensville, Pa.,	110¼in. x 10 feet.
Propeller Engine L. P. of SS. "Umbria," Cunard Line,	104in. x 6 feet.
" " L. P. of SS. "Pocahontas," Arrow Line,	150in. x 6 feet.
Caloric Engine of Air Ship "Ericsson" (1852),	168in. x 6 feet.

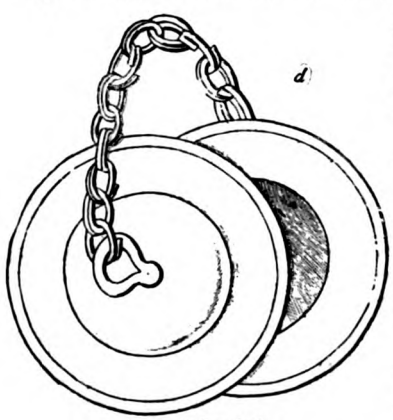
Cylindrical Surface. Formed by an indefinite straight line moving parallel to a fixed straight line, and constantly touching a fixed curve called the directrix; classified according to the character of the directrix, as circular, elliptical, etc. The successive positions of the moving lines are the elements of the surface.

Cyma. In classic architecture, a molding of a double curve, convex below and concave above. This is also designated Cyma recta; when the convex curve is uppermost the molding is known as Cyma reversa.

Cymatium. Upper member of an entablature, when molded in the form of a cyma.

Cymba. Form of sponge spicule found in the genus *Desmacidon*, shaped like C. Numerous modifications of this form exist.

Cymbals. Musical instrument of percussion, very ancient, consisting of thin plates of metal (an alloy of 78 copper and 22 tin) which are struck together by a sliding motion; chiefly used in military music.



Ancient Cymbals.

Cymbulia. See THECOSOMATA.

Cyme. Determinate flower cluster, generally more or less flat-topped, and either simple or compound, as in some Chickweeds and in the Elder.

Cymene. $CH_3.C_6H_4.C_3H_7$. Bpt. 176° C. Cymol or methylpropylbenzene; aromatic hydrocarbon of agreeable odor, found in Roman cummin oil, or prepared by the decomposition of camphor or turpentine.

Cymogene, or RHIGOLENE. Bpt. 18.6. Sp. gr. 0.62. Lowest boiling product which can be condensed in the distillation of petroleum. It contains pentane and butane, and is used as an anæsthetic and in ice-machines.

Cymol. See CYMENE.

Cymophane. Chrysoberyl, so called from its opalescent appearance.

Cymose. Methods of anthotaxy in which the main axis is terminated by a flower; also known as Definite, Determinate, and Centrifugal Inflorescence.

Cymry, or KYMRY. Welshmen; sometimes that branch of the Celtic race to which the Welsh belong, including the people of Bretagne and Cornwall.

Cymule. Small or partial cyme.

Cynarrhodium. Fruit consisting of a fleshy receptacle containing achenes, specially that of the Rose.

Cynewulf. Anglo-Saxon poet, perhaps identical with an abbot of Peterborough, 992–1008.

Cynics. Ascetic sect founded at Athens ab. 420 B.C. by Antisthenes: Diogenes was its most famous member. Popularly, one who has no confidence in the goodness of human nature, and is forever carping at its faults.

Cynipidæ. See GALLICOLA.

Cynocephalidæ. See CYNOPITHECIDÆ.

Cynodraco. See THERIODONTIA.

Cynoidea. Section of fissipede *Carnivora*, characterized by their digitigrade progression, non-retractile claws, five-toed forefeet and four-toed hindfeet, smooth tongue, and large tympanic bullæ. There are four præmolars, in front of two upper and three lower molars. All form one family, *Canidæ*, including the genus *Vulpes* (Foxes), with vertical slit-like pupil, and *Canes* (Dogs), with round pupils. The domestic dog has probably come from several wild species, the larger from the Wolf, the smaller varieties from Jackal-like forms. Some of the domestic breeds date back to prehistoric times. The Dingo of Australia is perhaps the only true wild dog known. Other forms are probably reversions from domestic importations, as in New Zealand. The eye is rounder in the dog, more oblique in the wolf. The ears are erect in the former, and drooping in the latter. The wolf hangs his tail, and howls instead of barking. Dogs readily become feral and lose their distinctive color-marks and their habit of barking. The period of gestation, 60 to 67 days, is the same for dog and wolf; they readily interbreed, producing fertile offspring.

Cynomorpha. See CATARRHINA.

Cynopitheci. See CATARRHINA.

Cynopithecidæ. Family of *Cynomorpha* or dog-like Apes, characterized by cheek pouches and ischial callosities. The tail is variable, long to rudimentary. The muzzle is prominent.

Sacred Baboon of Abyssinia (*Semnopithecus entellus*).

The fore limbs are usually longer than the hind limbs, and progression on the ground is quadrupedal and plantigrade. A

vermiform appendix is wanting. Two sub-families are included. 1. The *Cercopithecidæ*, including many small, graceful animals with long tails; here also belong the Macaques of s. Asia and the Barbary Ape of N. Africa and Gibraltar. 2. The *Cynocephalidæ*, or Baboons of Africa. They are large, have the limbs nearly equal in length, and run on all-fours with ease. The head is doglike. The natal callosities are conspicuous, often brightly colored. Examples are the Common Baboon of e. Africa, the Mandril of W. Africa, the Pig-faced Baboon of S. Africa, and the Sacred Baboon of Abyssinia.

Cynoscephalæ. Two hills in Thessaly, where the Roman Flaminius overthrew Philip V. of Macedon, 197 B.C.

Cynosura. Greek name for Ursa Minor, the Little Bear, the constellation containing the Pole Star. As it was by the latter that the Phœnician voyagers directed their course, cynosure came in time to signify anything to which attention is strongly directed.

Cynthia. See ASCIDIANS.

Cynthian. Epithet of Apollo, from Cynthus, a mountain in Delos, his birthplace.

Cyperaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Monocotyledons*, comprising 66 genera and ab. 2,200 species, distributed throughout all parts of the earth; commonly called the Sedge family.

Cyphella. Pits or small elevations on the lower surface of the lichen thallus.

Cy Pres. Doctrine that where a testator has expressed a general intention to create a trust for charity but has provided an ineffectual mode for exercising the trust, a court of equity will give effect to the intention by executing the trust in a manner as near as possible to the testator's wish. The doctrine has been adopted in many of the U. S., but rejected in others.

Cypress. *Cupressus sempervirens.* Evergreen tree of the natural family *Coniferæ*, native of the Levant, widely planted for ornament. Also other species of the same genus. The Bald or Deciduous Cypress of the s.e. U. S. is *Taxodium distichum.*

Cypress Vine. *Ipomœa vulgaris.* Scarlet-flowered, high climbing vine of the Morning Glory family, native of India, planted for ornament.

Cyprian, THASCIUS CÆCILIUS, ST., ab. 200–258. Bp. of Carthage 248. He was a vigorous advocate of episcopal unity and power, and ruled the Ch. wisely and efficiently in evil times. He withdrew from persecution 251, returned 252, was banished 257, and beheaded under Valerian.

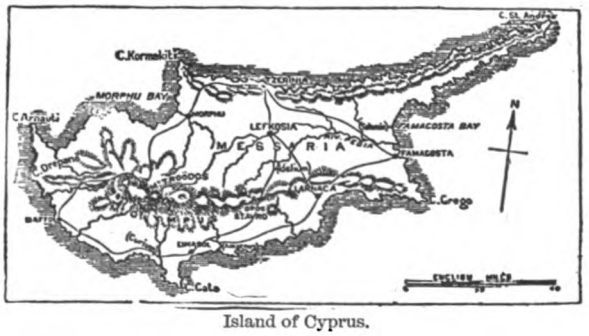
Cyprinidæ (FISHES). See EVENTOGNATHI.

Cyprinidæ (MOLLUSKS). Family of Lamellibranchs, with regular, oval, equivalved shell covered with strong epidermis. The hinge has one to three cardinal teeth, and one hinder lateral tooth. The pallial line is simple, and the mantle-edges fuse to form two siphons, an upper (dorsal) excurrent one, and a lower (ventral) incurrent one. It is because of these siphons that these clams can burrow in the sand, for the siphons stretch up and communicate with the water.

Cyprinodonts. Killifishes or Top Minnows; small freshwater fishes, with the top of the head flat, the mouth directed upward; they swim so as to gulp in the surface film of water. They live on insects, young snails, etc. During the breeding season they pair off. The sexes are quite different. Some are viviparous. See HAPLOMI.

Cypris. See OSTRACODA.

Cyprus. Island at e. end of the Mediterranean, area ab.



Island of Cyprus.

3,600 sq. m. It was colonized by Phœnicians and Greeks; was a chief seat of the worship of Aphrodite; was held successively by Phœnicians, Assyrians, Egyptians, Persians, the Ptolemies, Romans (58 B.C.), Saracens from 649, by kings of its own 1197–1487, by Venice till 1571, and by the Turks, who ceded to England 1878. Excavations have unearthed numerous objects of ancient art, many of which are in the New York Metropolitan Museum. Pop. about 210,000. See CESNOLA COLLECTION.

Cypsela. Modification of Achene, having the calyx tube adnate to the pericarp, as in plants of the family *Compositæ.*

Cypseli (CYPSELOMORPHA, MACROCHIRES). Sub-order of scansorial birds, including *Cypseloideæ* (Swifts and Hummingbirds) and *Caprimulgoideæ* (Goat-suckers). See FISSIROSTRES and TENUIROSTRES.

Cyrene. Greek city in n. Africa, w. from Alexandria, 9 m. from coast and 1,800 ft. above sea. Founded 631 B.C., from Sparta, it was ruled by kings till 430 B.C., was subject to the Ptolemies, and to Rome from 75 B.C.; destroyed ab. 616 by Chosroes. It gave name to a school of philosophers. ARISTIPPUS (q.v.), Callimachus, and Synesius, were born here.

Cyril, OF ALEXANDRIA, ab. 376–444. Patriarch 412; he presided at the Council of Ephesus 431 which condemned Nestorius.

Cyril, OF JERUSALEM, ab. 315–386. Bp. and patriarch ab. 350; opposed by Acacius of Cæsarea, thrice deposed and restored.

Cyril, OF THESSALONIA, 827–869. Apostle of the Slavs, with his brother Methodius; canonized 1881.

Cyrillaceæ. Natural family of flowering plants of the class *Angiospermæ*, and sub-class *Dicotyledons*, comprising 3 genera and ab. 6 species, natives of the s. portions of N. America; commonly called the Cyrilla family.

Cyril Lucar, ab. 1572–1638. Patriarch of Alexandria 1602, and of Constantinople 1621. Here his efforts for reform and toward union with Protestants brought him into constant troubles; he was repeatedly accused of treason, five times deposed, and at length strangled by the Sultan's order. His *Confession*, 1629, sets forth Calvinistic tenets.

Cyrtida. Division of *Ectolithia*, including *Radiolaria*, with the poles different, one being nearer the central capsule, which is divided into lappets toward the lower pole. The skeleton forms a close network. Many are bell-shaped, and sometimes constricted into segments.

Cyrtostyle. In classic architecture, a semicircular or segmental projecting portico.

Cyrus, THE GREAT, d. 529 B.C. Founder of the Persian Empire. Originally tributary to the Medes, he reversed the relation, and after conquering Lydia 540, took Babylon 538. He permitted the Jewish exiles to return to Palestine, and is mentioned in Isa. xliv., xlv. Herodotus makes him the son of Cambyses and grandson of Astyages.

Cyrus, THE YOUNGER, 424–401 B.C. Second son of Darius II.; satrap of Lydia. He attempted to dethrone his elder brother Artaxerxes Mnemon, and was slain at Cunaja.

Cyst. 1. Cavity with fluid or semi-fluid contents, usually separated from the surrounding tissues by a distinct membrane. 2. Protective covering about minute animals or their eggs.

Cysticercus, or BLADDER WORM. First stage of the life of a tapeworm after hatching from the egg which has been swallowed by some animal. The embryos bore into some organ of the body, become encysted and bud out tapeworm heads or scoleces. See SCOLEX and TÆNIADÆ.

Cystid. Cell in which the polypoid individual of a bryozoan colony lives.

Cystidia. Large inflated cells occurring in the hymenia of many *Fungi* of the Mushroom family.

Cystiphyllum. See RUGOSE CORAL.

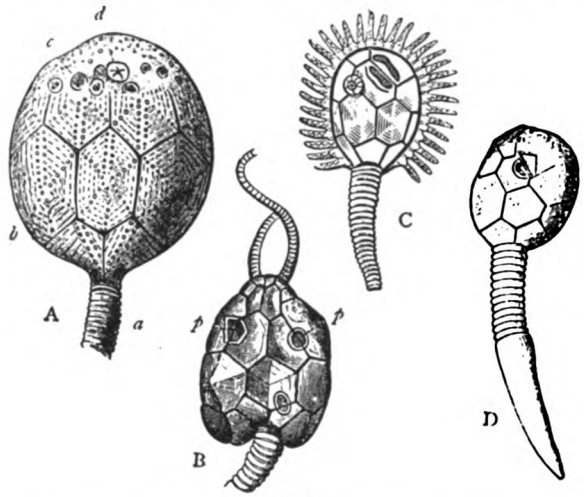
Cystitis. Inflammation of the bladder, in which there is pain and a constant and irrepressible desire to urinate. It may result from the taking of bodies, such as turpentine, which causes a flow of irritating urine, or from the presence of foreign bodies in the bladder, *e.g.*, calculus.

Cystocarp. Sporocarp of the *Floridiæ* or red *Algæ.*

Cystocele. Protrusion of the bladder into the vagina, due to weakening of the walls of the latter.

Cystoflagellata. See RHYNCHOFLAGELLATA.

Cystoidea (CYSTIDIA). Fossil Echinoderms, allied to the Crinoids. They have globular bodies, inclosed by plates, some



Cystideans.

A, *Caryocrinus ornatus*: *a*, Column; *b*, Calyx; *c*, Scars where pinnulæ were attached; *d*, Valvular pyramid. B, *Pleurocystites squamosus* (dorsal side): *p*, *p*, Two of the pectinnated rhombs. C, *Pseudocrinus bifasciatus*. D, *Lepadocrinus Gebhardi*.

of which are porous. The arms are rudimentary, and reproductive bodies are in the calyx. They are stalked or sessile.

Cystoliths. Stalked concretions of calcareous material, formed on a cellulose framework, occurring in the cells of *Urticaceæ* and some other plants.

Cystotomy. Surgical incision into the bladder, especially that performed for the relief of calculus.

Cytinaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising 7 genera and ab. 25 species, scattered through the temperate regions of Europe, Africa, and America, and the tropics of Asia.

Cytoblasts. Cell nucleus in "free cell formation."

Cytocormus. Colony of cells, which may be dyad, triad, tetrad, hexad, octad, etc., according to the number of cells. It may be temporary or permanent (meride), of similar (homoplasts) or dissimilar cells (heteroplasts, alloplasts).

Cytode. Animal or vegetable cell or unit constituting organic tissues. It usually refers to cells apart from the nucleus, but there is reason to believe that no cells without nuclei exist. The term is still retained, in the old sense in forming compounds; *e.g.*, cytoplasm.

Cytodieresis. Cell division in a broad sense and as occurring independently of nuclear division or of a true nuclear spindle or karyokinetic figure in a restricted sense.

Cytogenesis. Formation of plant and animal cells.

Cyto-hyaloplasm. Transparent portion of the cytoplasm of plant cells.

Cytology. Science of plant and animal cells. See CELLUAR BIOLOGY.

Cytophore. See BLASTOPHORE.

Cytoplasm. Protoplasm of a cell between the nucleus and the cell wall.

Cytostome. Mouth of a Protozoön.

Cytozoa. Genus of minute animals of a structure even simpler than that of an ordinary Protozoön (resembling a nucleolus), parasite in the blood corpuscles and other cells of some animals. It has been found in the red corpuscles of the frog, and Gaule has reported the presence of similar bionts in various other tissues, but he considers them as normal and a necessary part of the cell rather than as parasites.

Cyzicus. Greek town on s. side of Sea of Marmora; surrendered to Persians 494 B.C.; scene of victory of Athenians over Persians and Lacedemonians 410 B.C. It resisted Mithridates 74 B.C., whereon the Romans made it a free city.

Czar, or TSAR. Emperor of Russia. The Czarevitch is his eldest son.

Czardas. Hungarian national dance, frequently used in the Rhapsodies of Liszt and other Magyar composers.

Czartoryski, ADAM GEORGE, PRINCE, 1770–1861. Pres. of Poland Jan.–Aug., 1831; resident at Paris after the failure of the insurrection.

Czaslau. Town of Bohemia, 40 m. e.s.e. of Prague; scene of a victory gained by Frederick the Great over the Austrians May 17, 1742. Ziska was buried here.

Czech. Language spoken chiefly in Bohemia, with literature going back to the tenth century. See SLAVIC.

Czechs. Slavic tribe, who came ab. 475 from Carpathia into Bohemia; found also in Moravia and Upper Hungary. They number ab. 7,500,000.

Czelakovsky, FRANTISEK LADISLAV, 1799–1852. Bohemian poet, prof. at Breslau 1842 and Prague 1849. *Echoes of Russian Songs*, 1829; *Czech Songs*, 1840; *Slavic Proverbs*, 1852; *Literature of the Slavs*, 1877.

Czermak, JOHANN NEPOMUK, 1828–1873. Prof. at Cracow, Pesth, Jena, and Leipzig. *The Laryngoscope*, 1860; *Physiological Information*, 1864.

Czerny, GEORGE, 1766–1817. Liberator of Servia, and its prince 1808–1813; exiled; murdered by a partisan of his rival Milosch.—His son, ALEXANDER KARAGEORGEVITCH, 1815–1885, was Prince of Servia 1842–58.

Czerny, KARL, 1791–1857. Austrian pianist and composer, of Bohemian extraction; pupil of Beethoven; teacher of Liszt, Thalberg, Jaell, and other virtuosi.

Czerny, WENCESLAS, 1864–1894. Bohemian poet, dramatist, and translator of Shelley.

D

Dab. English school game in which a pin is put at random in a school book, between the leaves of which little pictures are placed.

Dab. *Limanda limanda.* Flat fish ab. 1 ft. long, common on the w. coasts of Europe. It belongs to the Flounder family and in Scotland is known as the Salt-water Fluke. An allied species, the Rusty Dab, is found on the coasts of New England.

Dab-Chick. *Podiceps fluviatilis* of the eastern hemisphere and *Podilymbus podiceps* of the western. The former is the smallest of GREBES (q.v.). The latter, known also as "devil-diver," "water-witch," is 14 in. long, brownish above, ashen below, with black and white bill and black throat, in summer; brown bill and black replaced by white in winter. It lives on small fishes. Sometimes confounded with the Coot.

Dabney, ROBERT LEWIS, D.D., LL.D., b. 1820. Prof. Union Theol. Sem., Va., 1853–83, Univ. Texas 1883. *Life of Gen. T. J. Jackson,* 1867; *Theology,* 1879.

Da Capo. In music an Italian term signifying "from the beginning," usually shortened to D.C., and marking a passage which is to be repeated to complete the movement.

Dacca. City of British India on the Boree Gunga, a

Najar Nuttoo Sing's Palace and Temple, Dacca.

mouth of the Ganges; noted for muslin manufactures. Pop., 1891, 83,760.

Dace. *Leuciscus vulgaris,* European fresh-water fish of the Carp family. It is ab. 8 in. long and, though not particularly good eating, its fighting qualities render it popular with the angler.

Dachshund. German badger-dog brought into fashion in England ab. 1850 by the Prince Consort who used it for pheasant-shooting. It has short, strong, crooked legs, useful in burrowing and in driving game to the gun where speed is not desired. It should be black or black and tan, weight 11 to 18 lbs., 10 in. high and 40 in. long from tip to tip.

Daci, or **Dacians.** Warlike race, occupying Upper Hungary, Wallachia, and vicinity from early times; originally called Getæ; subjugated by Trajan 106.

Dacier, ANDRE, 1651–1722. French translator of Plutarch and other classics.—His wife ANNE (LEFEVRE), 1651–1720, was still more noted for learning, and tr. Terence, Anacreon, and Homer.

Dacite. Collective name for the newer eruptice rocks, mostly accompanied by rhyolite, trachyte and andesite. Occur in n. w. America, Balkan Peninsula, and Hungary (Roman province of Dacia), whence the name. Formerly known as quartz-trachytes.

Dacoits. Brigands infesting Burmah and other parts of India. They were said to exceed 9,000 in 1887.

Da Costa, ISAAK, 1798–1860. Dutch Jew of Portuguese lineage, who became a Christian 1820. His *Four Witnesses,* 1840, tr. 1841, answered Strauss' *Life of Jesus.*

Dactylology. Art of talking by means of the fingers. See DEAF AND DUMB.

Dactylopodite. Terminal joint of the Crustacean endopodite (Walking-leg).

Dactylopterous. Having free fin rays, as in pectorals of some fishes.

Dactylozoöids. Mouthless, worm-like zoöids on a siphonophore colony.

Daddy-Longlegs. *Tipula oleracea.* Common European dipterous insect with very long body, legs, and antennæ. It appears from July to October, and its larvæ are destructive to vegetation. See PHALANGIDA.

Dado. In architecture, a die, or central vertical face, as in a pedestal; the lowest division of an interior wall, whether marked by wainscoting or by color.

Dadoxylon. Fossil tree found in Devonian strata. It was formerly supposed to be coniferous on the evidence of its microscopic structure, but its relationship is rather with *Cordaites,* and it is probably identical with *Araucarioxylon* and *Pinites.*

Dædalus. Mythical artist, who made the wooden cow for Pasiphæ, and the Labyrinth at Cnossus, Crete, in which to keep the Minotaur; also wings for himself and son Icarus, whereby he flew safely over the sea to Italy.

Dædalus, OF SICYON. Sculptor, son of Patrocles. Pausanias records famous works he executed ab. 400 B.C.

Daffodil. *Narcissus pseudo-narcissus.* Bulbous plant of the Amaryllis family, native of Europe, cultivated for its vernal flowers.

Common Daffodil. (*Narcissus pseudo-narcissus*).

Dagger. Sharp, two-edged instrument used principally for stabbing. Of Oriental origin, it came into use in France and England ab. 1350. The Dagger of Mercy was used to give the finishing stroke. In Spain and Italy it has always been freely used in private quarrels, and during the 16th century it was used with the rapier in duels, principally for parrying. The Scottish dirk, Italian stiletto, and Malay kris are noted varieties of the dagger.

Daghestan. Mountainous country of s.w. Asia between the Caspian Sea and Caucasus Mts. Conquered by the Czar Peter 1723, it was restored to Persia 1735 and re-annexed to Russia by Alexander I. 1813. Derbend is the capital. Lead, iron, and sulphur are found and the Daghestan rugs are prized. Pop., 1889, 597,356; area 11,492 sq. m.

Dagnan-Bouveret, Pascal Adolphe Jean, born 1852. French genre-painter.

Dagoba. See Tope.

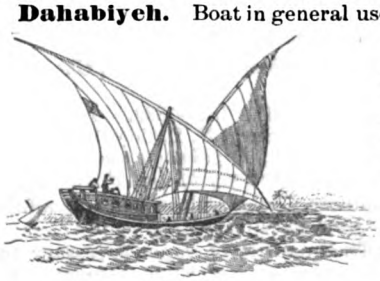
Dagobert I. King of France 631–638; codifier of the Frankish laws. Other Merovingians bore this name.

Dagon. Philistine deity, represented with a man's body and a fish's tail.

Daguerre, Louis Jacques Mande, 1789–1851. French scene painter and inventor of the Daguerreotype (q.v.).

Daguerreotype. J. C. Niepce of Chalons (1765–1833) conceived the idea of sun-pictures 1813, exhibited heliographs 1826, and is said to have printed from them. Daguerre's process for producing heliographic pictures was communicated to the French Government and published Aug. 1839; he was awarded a pension of 6,000 francs, and Niepce's son one of 4,000. The first photographic portrait from life was taken by Dr. John W. Draper of N.Y. City 1839. A silver plated copper plate is exposed to iodine and bromine vapors, producing a surface of iodide and bromide of silver. This is exposed in the camera, and then submitted to mercury vapor in a dark room, which develops the picture, by a deposit upon the part affected by the light. The unaltered silver salts are removed by hyposulphite of soda. See Photography.

Dahabiyeh. Boat in general use on the Nile. It has one, or sometimes two, masts with lateen sails, and is sailed, rowed, or towed, according to circumstances. The after-cabin for passengers is on an upper deck.



Dahabiyeh.

Dahl, Johann Christian Clausen, 1788–1857. Norwegian painter, prof. at Dresden 1821.

Dahlgren, Carl Fredrik, 1791-1844. Swedish lyric poet, dramatist, and novelist.

Dahlgren, John Adolph, U.S.N., 1809–1870. Inventor of the Dahlgren gun; commandant of navy yard at Washington 1861–62; rear-admiral 1863; commander of S. Atlantic blockading squadron 1863–65; and S. Pacific squadron 1866–68; chief of bureau of ordnance 1862–63 and 1868–70; author of several works on ordnance.

Dahlgren Gun. From 1845 to 1856 the armament of the U. S. Navy comprised six kinds of 32-lb. guns, varying in weight from 27 to 57 cwt., and two 8-in. shell guns of 55 and 63 cwt. Lieut. Dahlgren in 1850 recommended a modification of the old form of guns by accumulating a greater weight of metal about the breech, where it was needed, and diminishing that in front of the trunnions. This new form gave the gun an appearance similar to that of a champagne bottle, and was a decided departure from and improvement upon the old armament. It was adopted after a thorough trial in 1856, and held its place in the navy until the introduction of the modern breech-loading, built-up rifled gun. It was cast solid, cooled from the exterior, smooth-bored and chambered; it fired both spherical shot and shell, principally the latter. An 11-in. shell fired from a Dahlgren gun on the Kearsarge disabled the Alabama. The principal calibers were:

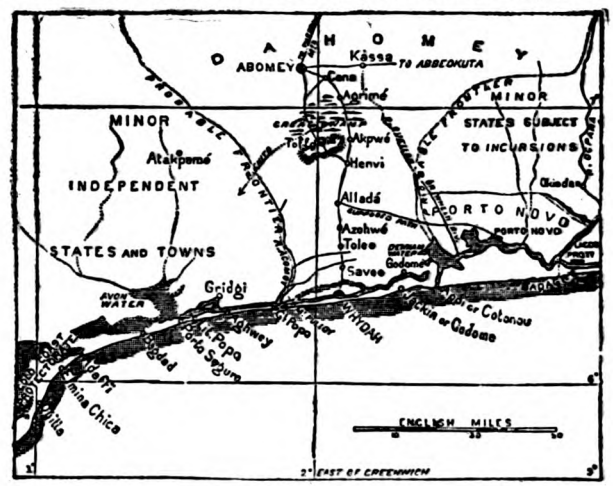
Cal.	Length of Bore.	Weight of Gun.	Charge.	Weight of Shot.	Weight of Shell.
9-in.	107.0-in.	9,200	10 to 13 lbs.	93	70
10 "	119.5 "	12,000	12.5 " 16 "	125	100
11 "	132.0 "	16,000	15 " 20 "	170	130
13 "	130.0 "	36,000	25 " 40 "	280	234
15 "	130.0 "	42,000	35 " 60 "	400	330

Dahlia. Genus of showy-flowered herbs of the Composite family, natives of Mexico and Central America, widely cultivated for ornament.

Dahlmann, Friedrich Christoph, 1785–1860. Prof. at Kiel 1813, Göttingen 1829–37, and Bonn 1842; historian of Denmark 1840–43, and of the French and English revolutions. *Sources of German History,* 1830. In later life he was active in liberal politics.

Dahn, Julius Sophus Felix, b. 1834. Prof. at Königsberg 1872, and Breslau 1888; jurist, historian, dramatist, novelist, and poet.

Dahomey. Native kingdom of w. Africa, under French protection since the war 1890–93. Pop. ab. 250,000; area ab. 4,000 sq. m. It lies between Lagos and the British Gold Coast. It is well wooded and all tropical fruits are abundant, but much swamp and marsh makes the climate very fatal to



Dahomey.

Europeans. The natives are hospitable, bold, warlike, but cruel and superstitious. The King is absolute and has a female bodyguard of 2,000 and a harem of 3,000. Human sacrifices are frequent and the annual festivals are attended with the torture and death of many hundreds of victims. Fetish and animal worship abounds. Capital Abomey.

Daillé, Jean, 1594–1670. French Protestant. *Right Use of the Fathers,* 1632, tr. 1651.

Daimios. Territorial nobles of Japan, over whom a victory was gained by Iyeyasu at Sekigahara 1600, establishing the Tokugawa dynasty. He introduced the feudal system, and they became his vassals. Each fief was ruled by a *hau* (clan) with the daimio as chief; rules and usages differed in the several haus. In 1871 the daimios gave up their power; they are now classed with the old court nobles and reside at Tokio.

Dairy. Herd of cows, with the implements and appurte-

Dairy.

nances used in the manufacture of butter and cheese. From 1881–90 the U. S. imported 196,226 pounds of butter and 7,373,-

239 pounds of cheese and exported 18,827,211 and 104,207,285 pounds respectively. See BUTTER, CHEESE, CHURN, CREAM SEPARATOR, and MILK.

Dais. In architecture a raised seat, table or platform, erected as a place of special honor.

Daisy. *Bellis perennis.* Common and beautiful weed of Europe, occasionally cultivated. Also *B. integrifolia*, native of the western prairie region. Other species exist, all of the natural family *Compositæ.*

Daisy, OX-EYE. *Chrysanthemum leucanthemum.* Common white-flowered plant of the Composite family, native of Europe, abundantly introduced as a pernicious weed into N. America; known also as White Daisy and White-weed. It is troublesome in meadows, particularly those that are thinly seeded and infertile. When cut early and made into hay, it is readily eaten by cattle and is fairly nutritious. It is an annual and seeds abundantly, but in fertile and well cultivated land the grasses and clovers will crowd it out. Its presence is a sign of worn soil and careless culture.

Dakoits. See DACOITS.

Dakota. Part of the Louisiana Purchase, separated from Minnesota 1861, and organized as a Territory. Its boundaries were determined 1868, when Wyoming was set off from it. It was admitted to the Union 1890 as NORTH and SOUTH DAKOTA (q.v.).

Dakota Indians. See SIOUX.

Dalberg, KARL THEODOR ANTON MARIA VON, 1744–1817. Abp. and Elector of Mayence 1802; Primate of Germany 1806; raised and ruined by alliance with Napoleon.

D'Albert, EUGENE, b. 1864. Scotch musician, studied in London and Vienna and attained fame as a pianist and composer.

Dale, JAMES WILKINSON, D.D., 1812–1881. American divine. *Classic, Judaic, Johannic,* and *Patristic Baptism,* 4 v., 1867–74.

Dale, RICHARD, U.S.N., 1756–1826. Commodore 1801. He served in the Revolutionary War and against Tripoli.

Dale, ROBERT WILLIAM, D.D., LL.D., 1829–1895. Cong. pastor at Birmingham, Eng., from 1853. *Atonement,*1875; *Ephesians,* 1882.

Dale, THOMAS, 1797–1870. English sacred poet.

D'Alembert, JEAN LE ROND. See ALEMBERT, JEAN D'.

D'Alembert's Principle. Employed for reducing the determination of the motions of material systems to the conditions of solution of statical problems. The earliest step toward its discovery is found in a memoir by James Bernoulli in the *Acta Eruditorum,* 1686. It is this: if the effective moving forces of the several particles of a system be applied to them in directions opposite to those in which they act, they will conjointly with the impressed moving forces constitute a system of forces statically disposed. See ALEMBERT, JEAN D'.

Dalgarno, GEORGE, ab. 1626–1687. Scottish educator and author. His *Ars Signorum,* 1661, was praised by Leibnitz and used by Bp. Wilkins in *Philosophical Language,* 1668. *Deaf and Dumb Man's Tutor,* 1680.

Dalhousie, JAMES ANDREW BROUN-RAMSAY, MARQUIS OF, 1812–1860. Governor-general of India 1847–56; M. P. 1835; Earl 1848; Pres. Board of Trade 1845; Marquis 1849. He originated great reforms in the Indian service.

Dalin, OLOF VON, 1708–1763. Swedish historian and poet.

Dall, WILLIAM HEALEY, b. 1845. Assistant on U. S. Coast and Geodetic Survey; curator National Museum; writer on Alaska. —His mother, CAROLINE WELLS (HEALEY), b. 1822, m. 1844, has pub. many books.

Dallas. Village of n.w. Georgia, scene of conflicts between Sherman's forces and the Confederates under Johnston, May 25–29, 1864.

Dallas. City of Dallas co., n.e. Texas, on e. bank of Trinity River. Pop., 1890, 38,067.

Dallas, ALEXANDER JAMES, 1759–1817. U. S. Dist. Atty. 1801–14; Sec. Treasury 1814–16. *Reports of Cases in Courts of U. S. and Pa.,* 4 vols., 1790–1807.—His son, GEORGE MIFFLIN, LL.D., 1792–1864, was U. S. Senator from Pa. 1831–33, Minister to Russia 1837–39, Vice-Pres. U. S. 1845–49, and Minister to England 1856–61. *Letters from London,* 1869; *Diary* (in Russia) 1891.

Dall' Ongaro, FRANCESCO, 1808–1873. Italian poet and journalist, noted for his *Stornelli,* lyrics commemorating the revolution of 1848; prof. at Florence 1859.

Dalmatia. S. part of Illyria, on the Adriat ; conquered by the Romans 39–23 B.C.; held in turn by Goths, Hungarians and Turks, till ceded to Venice 1699; given to Austria by treaty of Campo Firmio 1797. Area 4,940 sq. m.; pop. ab. 530,000, mostly Slavs.

Dalmatic.

Dalmatian Dog. Of the same size and general build as a pointer, in his own country he is used for similar purposes, but elsewhere only as a carriage dog, as he will run at a horse's heels 20 m. a day without tiring. The markings should be spots not less than 1 in. diameter evenly distributed on a short white coat.

Dalmatic. Ecclesiastical robe with sleeves, thus differing from the cope and the chasuble; worn by R. C. deacons.

Dalrymple, SIR DAVID, LORD HAILES, 1726–1792. Scottish judge and author. *Annals of Scotland,* 1776–79; *Christian Antiquity,* 1776–80.—His brother, ALEXANDER, 1737–1808, was hydrographer to the E. India Co. and the Admiralty.

Dalton, JOHN, LL.D., D.C.L., F.R.S., 1766–1844. English chemist, father of the Atomic Theory. He taught at Manchester from 1793. *Meteorological Observations,* 1793; *Chemical Philosophy,* 1808–27.

John Dalton.

Dalton, JOHN CALL, M.D., LL.D., 1825–1889. American physiologist. Prof. Coll. Phys. and Surg. N. Y. City, 1855–1883, Pres. 1884. *Human Physiology,* 1859; *Physiology and Hygiene for Schools,* 1868; *Topographical Anatomy of the Brain,* 1885.

Daltonism. Color blindness. John Dalton had this affection in a remarkable degree, and carefully described it.

Dalton's Laws. 1. The quantity of vapor necessary to saturate a given space is the same at the same temperature whether the space contains another vapor or gas, or is a vacuum. 2. The pressure of a mixture of a gas and a vapor is equal to the sum of the pressures which each would exert if it occupied the same space alone. The application of these laws to the aqueous vapor of the atmosphere is exceedingly restricted by the fact that the time required for complete diffusion is very long as compared with the rapid changes produced by wind, evaporation, and precipitation. These laws were announced by John Dalton in 1826.

Daly, CHARLES PATRICK, LL.D., b. 1816. Judge N. Y. City Common Pleas, 1845–1886. *Surrogate's Courts in N. Y.,* 1863; *Reports of N. Y. Com. Pleas,* 15 vols., 1868–91.

Daly, JOHN AUGUSTIN, b. 1838. Manager of theaters in New York since 1869; author and adapter of several plays.

Dam. Wall or stopping constructed to prevent the passage of gas or water from one part of a mine to another. See DAMS.

Dama. Tribe inhabiting the w. coast of S. Africa, numbering more than 100,000. They are large and powerful, ride horses, use wagons and breech loaders, and wear their hair in braids down the back. Their clothing consists of a small apron and numerous bells and ornaments; the women also wear a

head-dress, and are the laborers. They are loquacious, love dances and music, but lack perseverance. Youths on growing up knock out the lower inciosrs. The corpse is buried with the utensils owned in life.

Damages. Award of the law for the redress of actionable injuries. An act which harms another without entitling him to damages is *Damnum absque injuria*, as where one, in the lawful use of his land, impairs the value of his neighbor's. Damages are compensatory, when they simply pay for the harm; exemplary, vindictive, or primitive, when besides compensating the plaintiff they punish the defendant, as in aggravated cases of libel; nominal, when they are a trifle as compared with the cost of obtaining them. A verdict for nominal damages may mean that the action is brought to establish a right, when no damage beyond the denial of the right has been sustained, or that the jury have a poor opinion of the plaintiff, although he has been technically wronged.

Damascene, ST. JOHN, ab. 694–780. Greek theologian and hymnist, from 730 a monk of St. Saba near Jerusalem.

Damascenus, NICHOLAUS. Greek historian, friend of Augustus and Herod the Great. Fragments of his works remain.

Damascius, b. ab. 480. Neoplatonic teacher at Athens and in Persia. His *First Principles* survives.

Damascus. Chief city of Syria, in a fertile plain e. of the Anti-Libanus, watered by 7 canals drawn from the River Barada. It is of remote antiquity, one of the oldest of cities, see Gen. xiv. 15. It was held by one after another of the great Oriental empires, was taken by the Romans 65 B.C., by the Saracens 634, and by the Turks 1516. It was the scene of St.

Damascus—View taken from the Christian Quarter.

Paul's conversion. D. blades (swords) were formerly made here. D. was famous as early as the 12th century for its figured silks; hence damask as applied to fabrics of silk, linen, etc. The Damson plum is also named from D. It has a large trade and extensive manufactures. Pop. ab. 200,000, less than one-tenth Christian.

Damask. Linen or silk fabric with ornamental patterns of flowers and animals woven in the looms. It was beautifully imitated by the Dutch and Flemings, and introduced into England by the fugitives from Alva's persecutions 1573.

Damaskeening. Art of incrusting or inlaying one metal with another in an ornamental pattern or design. It took the name from Damascus, the many-colored watered blades of that city being highly prized during the Middle Ages. This true damaskeening was produced by using a cast-steel highly charged with carbon, which, by careful cooling, effected the peculiar crystallization desired. Another species of damaskeening is ornamental etching on polished steel. A third method was by deeply cutting the design and filling the grooves with metal wire by hammering. The metals commonly used were silver or gold on copper or iron, gold on silver, or silver on gold.

Damasus I., ST., ab. 305–384. Bp. of Rome 366. He repressed the Arians, encouraged Jerome to tr. the Bible, introduced the Psalter, left poems and letters, and was canonized; Dec. 11 is his day.—II. Pope 1048.

Dambose. $C_6H_{12}O_6$. White crystals, carbo-hydrate, present as a methyl ether in several varieties of rubber; obtained by the action of hydriodic acid upon the ether; found in the muscles of the heart, and in unripe peas and beans.

Dambula. Buddhist rock-temple in Ceylon, near Matellæ, endowed 86 B.C. Some of the statues of Buddha here are more than 40 ft. high. The Makara, a monstrous idol with elephant's trunk, lion's feet, crocodile's teeth, and pig's ears, is also famous.

Damiana. Leaves of *Haplopappus discoideus*, and some species of *Turnera;* highly but falsely vaunted at one time as an aphrodisiac.

Damiani, PIETRO, 988–1072. Bp. of Ostia and Cardinal 1057; ascetic, reformer, doctor, and poet; canonized.

Damianists. Monophysite sect, followers of Damian, Patriarch of Alexandria ab. 520.

Damien, FATHER, orig. JOSEPH DE VEUSTER, 1840–1889. Belgian missionary among the lepers of Molokai, Sandwich Is., from 1873.

Damiens, ROBERT FRANCOIS, 1714–1757. Would-be regicide of Louis XV. of France, executed with frightful tortures.

Damietta. Town of Lower Egypt, on e. mouth of the Nile; founded ab. 1251, near the site of Tamiathis, which had been taken by the Crusaders after a 16 months' siege 1218, and by assault by Louis IX. 1249, but restored 1250. The French took it 1798. It gives the name Dimity to a cambric first made here. Pop. ab. 55,000.

Dammar. Resin produced by several trees of the genus *Araucaria*, natural family *Coniferæ*, natives of the S. Pacific Islands.

Damocles. Syracusan, who extolled the fortune of Dionysius the Elder. The tyrant, to show the nature of royal felicity, set him at a banquet with a sword suspended over his head by a hair.

Damon and Pythias (or **Phintias**). Pythagoreans of Syracuse, models of friendship. P. being condemned to death, D. took his place in prison. Returning in time, P. was pardoned by Dionysius.

Damourite. Group of minerals resembling ordinary mica; also called Hydromica.

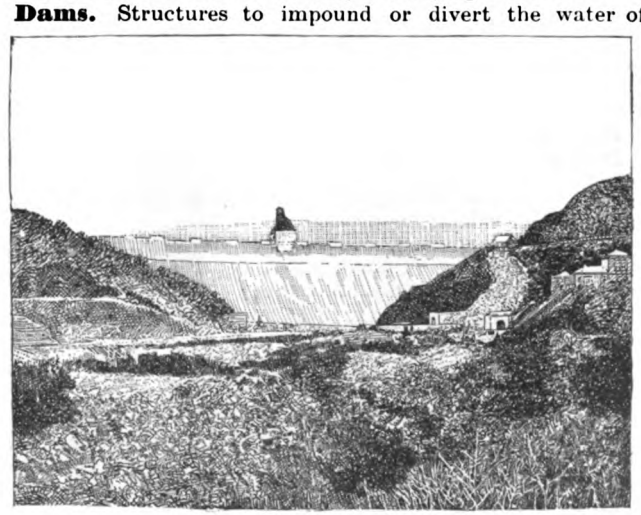
Damper. Valve in a flue or chimney, by which the flow of hot gases may be checked and combustion retarded in the fire. Two types are used: 1st, the swinging or butterfly, mounted on a horizontal axis, about which it swings; 2d; the sliding or guillotine, or gate in which a flat plate slides in a frame to close the passage. The first kind is self-balanced. Automatic regulation is often attained by connecting a weighted lever to the damper, the weight being raised to close the damper by pressure of steam under a flexible diaphraghm, when the pressure exceeds a certain amount.

Damper. Mass of copper in the shape of a plate or hollow box, placed near a vibrating magnetic needle. The object is to bring the needle to rest by the action of the induced currents in the copper plate.

Dampier, WILLIAM, 1652–1715. English navigator, who preyed on the Spanish settlements in the E. and W. Indies 1679–88, and led an expedition to the South Sea 1699–1701. His *Voyage Round the World*, 1697, is still valued.

Damrosch, LEOPOLD, 1832–1885. German musician, who came to New York 1871 as conductor of the Männergesangverein Arion, and founded the Oratorio and Symphony Societies 1873–78.—His son, WALTER, b. 1862, succeeded him as conductor of these, and was asst. director at the N.Y. Metropolitan Opera House 1886–91, Director 1894.—Another son, FRANK HEINE, b. 1859, founded N. Y. People's Singing Classes.

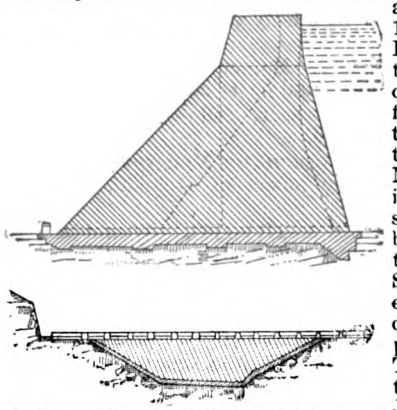
Dams. Structures to impound or divert the water of



Gileppe River Dam, Belgium.

streams. In India 43,000 reservoirs, mostly with earth embankments, have been built for irrigating purposes; one of these has

a dam nearly 30 miles long. When water is to flow over the top of a dam it must be built of timber or stone. The largest masonry dams are those at Villar in Spain, 175 feet high, and at Furens in France, 174 ft. high. The Quaker Bridge Dam, proposed for the Croton water supply of New York, is to be 265 ft. high, 22 ft. wide at the top, and 216 ft. wide at the base. The dam at San Mateo, Cal., 170 ft. high, is built of concrete. Masonry dams are usually built with curved profiles, to economize materials. Several failures of earthen dams, causing much destruction of life and property, have occurred. The most disastrous was that of the reservoir at Johnstown, Pa., which failed on May 31, 1889, causing the loss of 2,142 lives and nearly $4,000,000 worth of property. This dam was well built, but its waste weir was obstructed and insufficient to discharge the excessive rainfall of 10 inches which fell in about 24 hours.



Section of Masonry of Dam and Reservoir.

Damson. Variety of the cultivated plum, bearing small, bitter fruit.

Dan. Fifth son of the patriarch Jacob, and ancestor of one of the twelve tribes of Israel. Its character was strong and rude, as exemplified in its great hero, Sampson.

Dana, CHARLES ANDERSON, b. 1819. American journalist; asst. Sec. of War 1863-64; ed. N.Y. *Sun* from 1868; *Household Book of Poetry*, 1857, and with G. Ripley *New American Cyclopædia*, 1855–63.

Dana, JAMES DWIGHT, LL.D., 1813–1895. Mineralogist and geologist to the Wilkes Exploring Expedition, 1838–42; prof. Yale 1855–92; ed. *Am. Journal of Science and Arts*. *System of Mineralogy*, 1837; *Manual of Mineralogy*, 1848; *Geology of the Pacific*, 1849; *Coral Reefs and Islands*, 1853; *Manual* and *Text-Book of Geology*, 1863–64; *Geological Story*, 1875; *Volcanoes*, 1890.—His son, EDWARD SALISBURY, b. 1849, prof. Yale since 1879, has pub. text-books of Mineralogy and Mechanics, 1877–81.

Dana, RICHARD HENRY, 1787–1879. American poet and essayist. *The Idle Man*, 1821–22; *The Buccaneer*, 1827.—His son and namesake, 1815–1882, wrote *Two Years before the Mast*, 1840; *Seaman's Friend*, 1841; and *To Cuba and Back*, 1859; ed. Wheaton's *International Law*, 1866, became LL.D., and was prominent at the bar and in public affairs.—The poet's father, FRANCIS, LL.D., 1743–1811, was Judge of Mass. Supreme Court from 1785, and Chief-Justice 1791–1806.

Dana, WILLIAM PARSONS, b. 1833. N. A. 1863. American painter of sea and figure subjects.

Danæ. Daughter of a King of Argos, confined by her father in a brazen tower; visited by Zeus in the form of a shower of gold, she became the mother of Perseus.

Danai. Argive Greeks; so named from Danaüs, who fled from Libya to Argos.

Danaides. Fifty daughters of Danaus, King of Libya. With one exception they slew their husbands, the 50 sons of their father's twin brother, Ægyptus, and were punished in Hades by being compelled forever to pour water into a sieve.

Danaite. Variety of arsenopyrite found at Franconia, N. H.

Danakil. Nomadic tribes of half Ethiopic, half Arabic blood occupying the low-lying, waterless, trackless, and uncultivated region between Abyssinia and the Red Sea. The slave trade is their chief support.

Danalite. Mineral associated with the granite of Cape Ann, Mass., and containing iron, zinc, beryllium, and manganese, with silica and a small amount of sulphur.

Danburite. $CaB_2Si_2O_8$. Calcium borosilicate, found originally at Danbury, Conn.

Danbury. City of Fairfield co., Conn., noted for hat factories; founded 1684, burned 1777. Pop., 1890, 16,552.

Danby, FRANCIS, 1793–1861. Irish landscape painter.

Danby, THOMAS OSBORNE, 1631–1712. Lord Treasurer 1673, Earl 1674; impeached 1678, and imprisoned till 1683; Marquis of Carmarthen 1699, Duke of Leeds 1694.

Dance Music. Differentiated by rhythm and accent from ch. music in the earlier Christian centuries. Nearly all secular music was dance music, and, so far as the record goes, all dance music was vocal till ab. 1500, when the first music for lutes, organ and clavichord appeared. Instrumental music at the time was only a transcription of vocal, and compositions were interchangeable between voices and instruments. The introduction of dance pieces into artistic music led to the development of the loftiest classical forms, the SONATA (q.v.) and SYMPHONY (q.v.). In the 17th century the following French, Italian, and Spanish dances became popular with composers: Allemande, Branle, Bourrée, Canarie, Chaconne, Courante, Gagliarde, Gavotte, Gigue (Jig), Loure, Moresca, Paduana, Passacaglia, Passepied, Passe Mezzo, Pavane. Rigaudon, Romanesca, Sarabande, Saltarello, and Volta. They were used in operas, and a number of them grouped together were called a SUITE (q.v.).

Dance of Death. Typical subject in late Mediæval Art, especially affected in Germany; or treated there with greatest success. It represented the triumph of death by

Holbein's Design for a Dagger Sheath.

corpses or skeletons, connected with living figures and leading them in the dance. The origin of such pictures was a simple religious drama in form of a dialogue between Death and a number of followers.

Dancetté. One of the heraldic partition lines. It crosses the shield in a broad horizontal zigzag.

Dancing. Among all the nations of antiquity dancing was used in the service of religion, as it still is in the East and among savage tribes. Various nations also had military dances, and some of these long survived, as in the Swiss and Scotch sword-dances. The priests of Isis, Baal, Dionysus, Bacchus, Brahma and Mars all accompanied their solemnities with dancing. The pantomimic dance was highly esteemed among the Greeks; Athenæus says they had so perfected it in imitating the passions that the sculptors studied the attitudes of the public dancers and owed to this the beauty of their work. The Spartans made gymnastic dances compulsory for children of 5 to 12 years of age. In Rome dancing was considered disgraceful except as a religious rite until the Augustan Age, when pantomimic dances were introduced and famous performers received princely honors. After the fall of the Empire the Gauls alone kept up the theater and ballets while the Goths introduced martial dances. Early Christianity adopted pagan choreographic rites, and in the churches a space was set apart where the youth of both sexes performed devout ballets and sometimes even bishops led the "branle." Consequent license evoked the Church's interdict and this species of dance was rarely seen again till its revival in Italy in the 16th century. During the Middle Ages it was largely confined to the minstrels and joculators. After the Renaissance the national dances of the common people gradually found their way to court, and society adopted stately measures and rough revels as a recreation.

Dancing Mania. Epidemic frenzy which began at Aix-la-Chapelle 1374, and was known in cities of Germany till the 17th century. The subjects of it saw visions, screamed, foamed at the mouth, danced in procession from town to town, cursing the priests, till utterly exhausted; many lost all control of themselves; some dashed out their brains against the walls. For a time exorcism was an efficacious remedy; later, Paracelsus used cold water with success. In the 17th century the disease was known as St. Vitus's Dance. It was akin to hysteria.

Danckelmann, ALEXANDER VON, b. 1855. Prof. at Leipzig; writer on the climatology of Africa.

Dancourt, FLORENT CARTON, 1661–1725. French comic dramatist.

Dandelion. *Taraxacum taraxacum.* Weed of the natural family *Cichoriaceæ*, native of the n. hemisphere; widely diffused. It has edible leaves and a root with bitter and tonic properties.

Dandelion, DWARF. *Adopogon carolinianum.* Low, yellow-flowered plant of the Chicory family, native of e. N. America.

Dandelion, FALL. *Leontodon autumnale.* Yellow-flowered plant of the Chicory family, native of Europe; introduced into N. America; known also as Hawkbit.

Dandelion, FALSE. Plants of the genus *Pyrrhopappus*,

natural family *Cichoriaceæ*, bearing yellow flowers; natives of the s. U. S.

Dandolo, ENRICO, 1108–1205. Doge of Venice 1192. Though blind and aged, he led the 4th Crusade, took Constantinople in 1204, founded the Latin Empire there, declining the crown, and greatly extended the Venetian territories. His family furnished three other doges, and lasted for centuries.

Enrico Dandolo.

Dandridge, MRS. DANSKE (BEDINGER), b. in Copenhagen ab. 1856. American poet. *Rose Brake*, 1890.

Dandruff. Branny scales which form on the scalp; dried cells of the epidermis, or result of disease of the scalp.

Dandy Fever. See BREAKBONE FEVER.

Dane, NATHAN, LL.D., 1752–1835. Member of the Continental Congress from Mass. 1785–88. He drew up the North West Territory ordinance 1787. *Abridgment of American Law*, 9 vols., 1823–29.

Danegeld. Tax on land, levied by Ethelred II. to buy off the Danes; reimposed by William I.

Danelagh. Parts of England in which Danish language and customs were introduced.

Danenhower, JOHN WILSON, U.S.N., 1849–1887. Arctic explorer. *Narrative of the Jeannette*, 1882.

Danes. People of Low German origin, who invaded England 789 and frequently afterward, conquered East England under Guthrum 878, and subdued all England under Sweyn 1013, who became king of England. Cnute, his son, reigned over England, Denmark, and Norway 1017–35. With other Northmen under Rolf they acquired Normandy 913.

Dangerous Zone. As a small-arm rifle is usually fired with the muzzle 4 to 5 ft. above the ground and aimed at a point ab. 3 ft. above, a man 5 ft. 8 in. tall could be disabled in any position front or rear of the point aimed at where his height would intersect the falling part of the trajectory. The depth of the danger zone will be increased with a fleet trajectory and a less range; hence the new U. S. infantry rifle has a greater danger zone than the old Springfield rifled musket.

Dangleberry. *Gaylussacia frondosa.* Shrub of the Huckleberry family, native of e. n. America, bearing edible berries; known also as Blue Tangle.

Dangs, THE. Jungle tract of the Syhadri range in Bombay; area ab. 1,000 sq. m.; pop. 45,485. It is unhealthy and timber is the only product. The country is occupied by fifteen hill-tribes, of whom the Bhils are the most important.

Daniel. Twenty-seventh O. T. book, containing marvelous narratives of deliverance and apocalyptic visions of the fortunes of the Kingdom of God under various great monarchies, and its final triumph over all; commonly ascribed to the Jewish captive Daniel, minister of several Babylonian and Persian kings; more probably to the Maccabean era, ab. 170 B.C.

Daniel, ARNAUT, ab. 1200. Provencal poet, praised by Dante.

Daniel, HERMANN ADALBERT, Ph.D., 1812–1871. Prof. at Halle 1854–70. His *Thesaurus Hymnologicus*, 5 v., 1841–55, is a work of great importance. *Codex Liturgicus*, 4 v., 1847–54. His *Guide to Geography* was widely used.

Daniel, JOHN MONCURE, 1825–1865. Ed. Richmond (Va.) *Examiner*, U. S. minister to Italy, 1857–61.

Daniel, JOHN WARWICK, b. 1842. M.C. from Va. 1885–87, U. S. Senator from 1887. *Law of Negotiable Instruments*, 1876.

Daniel, SAMUEL, 1562–1619. English poet. *Cleopatra*, 1594; *Wars of York and Lancaster*, 1595; and a prose *Defense of Rhyme*, 1602, and *History of England*, 1613–34.

Daniell, JOHN FREDERIC, D.C.L., F.R.S., 1790–1845. Prof. King's Coll., London, 1831; inventor of a galvanic battery, a hygrometer and a pyrometer. *Meteorological Essays*, 1823; *Chemical Philosophy*, 1839.

Danielsson, OLOF AUGUST, b. 1852. Swedish philologist. Prof. Univ. Upsala 1891. *Grammatiska Anmärkingar*, 1881–83; *Grammatische und etymologische Studien*, 1888; *Epigraphica*, 1890.

Danish Language. A member of the Scandinavian branch of the Germanic group, spoken now in Denmark, but once prevailing in certain parts of Sweden and of Great Britain. As a literary language it began with the 13th century. Originally almost identical with Swedish, it has become a separate tongue; while, on the other hand, it is now the language of Norway, barring a few differences in vocabulary and pronunciation. Two striking peculiarities of the language are an independent passive voice for the verb, and a suffixed definite article for the noun.

Danish Literature. Began in the vernacular about the 14th century, but has little to offer of interest or value, so far as its early stages are concerned, with the exception of the ballads. These, composed from the 11th to the 15th century, have been published in various modern collections; the best is Svend Grundtvig's *Danmarks Gamle Folkeviser*, Copenhagen, 1853. An English translation of some of the best ballads is Prior's *Ancient Danish Ballads*, 1860. For the rest, little but learned and theological works appeared until the time of Holberg (a Norwegian by birth, 1684–1754), who may well be called the creator of Danish literature. He is best in his comedies (as *Jeppe paa Bjerget*), but he achieved success in other directions. The next great name is that of Oehlenschläger (1779–1850), who represents the romantic school in Denmark, and is best known by his fine tragedy, *Haken Jarl*. In quite another vein, but still romantic in tendency, was the more famous Hans Christian Andersen. Of recent years the critical and realistic school has the upper hand; Georg Brandes, b. 1840, is its best known representative. The identity of language in Denmark and Norway makes it almost impossible to separate the two literatures; Bjornson, Ibsen, Kiellund, Lie and other Norwegian writers have as familiar a public in Denmark as at home.

Danites. Mormon society, formed 1838 by Joseph Smith for defense, and later employed to keep Utah from free Gentiles and commit other acts of violence. For the Mountain Meadow massacre of 140 emigrants, 1857, Bp. John D. Lee was hanged 1877.

Dannat, WILLIAM T., b. 1853. American figure painter, especially of Spanish subjects. A large canvas, *A Quartette*, is in the Metropolitan Museum, N. Y.

Dannebrog. Banner of Denmark, reputed to have fallen from heaven in a fight against the heathen 1219. The Order, instituted 1219, was reorganized 1671.

Dannecker, JOHANN HEINRICH VON, 1758–1841. German sculptor of Stuttgart, a follower of the Greek Revival style, inferior only to Canova and Thorwaldsen. His best known work is the *Ariadne* in Frankfort-on-the-Main.

Dannevirke. Rampart, 25 to 35 ft. high, built across Schleswig ab. 808, to protect the Danes against the Franks.

Dannhauer, KONRAD, 1603–1666. Prof. Strassburg from 1628; Lutheran theologian, who attacked Catholic, Calvinist, and Syncretist doctrines.

Dan-no-ura. Japanese naval battle, near Shimonoseki, in Kiushiu, in 1185. The Taira clan, which had been in power through the reigns of 9 emperors, was defeated by the Minamoto, which was thenceforth supreme. Most of the Taira clan perished. The emperor Ankotu, 82d of his line, was drowned.

Dante. ALIGHIERI, 1265–1321. Greatest of Italian poets. His earlier works are the *Vita Nuova* and the *Convito*. His

masterpiece, *La Divina Commedia*, consists of three parts: the *Inferno*, which depicts evil; the *Purgatorio*, which paints the

process of moral purification, and the *Paradiso*, representing final and perfect purity. The poem is allegorical, but he used historical characters in its construction. It is based on the mediæval theology, yet it attacked the Church. It has been called a drama or epic of the soul, and in its scheme embodies both the pagan and the Christian world. It has been tr. by H. F. Caryn 1814, and Longfellow 1867. Dante's political career is memorable. He espoused the cause of the Guelphs and fought in its behalf, was sent on political missions to foreign courts, was elected 1300 Prior of Florence, and was banished 1302, when the Neri faction of the Guelph party, to which he belonged, was overthrown. He died in exile.

Danton, GEORGES JACQUES, 1759–1794. French Revolutionist. He founded the Cordeliers; instigated the insurrection of Aug. 10, 1792; became minister of justice, sharing the supreme power with Robespierre and Marat; was a member of the Committee of Public Safety; incurred the jealousy of Robespierre, and was guillotined.

Dantzic. Fortified seaport on left bank of the Vistula, w. Prussia; an important town as early as 997; under control of the Teutonic Knights 1308–1455, when it became nominally subject to Poland: was for a time an important member of the

Dantzic.

Hanseatic League; was assigned to Prussia at 2d partition of Poland 1793. The French took it by siege 1807; the Allies 1813. It has an extensive commerce and some manufactures. Pop., 1890, 120,459.

Danube. One of the great rivers of s. Europe. Heads in the mountains of s. Germany, and flows generally s. e. across Austro-Hungary, thence nearly e., serving as the n. boundary of Servia and Bulgaria, to its mouth in the Black Sea, which it enters through a delta of 1,000 sq. m. Length 1,613 m., drainage area 299,435 sq. m. Its volume at its mouth is 200,000 cub. ft. per second. It is navigable below Ulm. It has 100 navigable tributaries, and is connected with the Rhine and the Elbe by canals. Since the Peace of Paris, 1856, it has been free to ships of all nations, and is controlled from the Sea to the Iron Gate, below Orsova, by an International Commission.

Danville. Capital of Vermilion co., Ill., on Vermilion R. Pop., 1890, 11,491.

Danville. Town of Pittsylvania co., Va., on the Dan R. Pop., 1890, 14,104.

Daphne. Daughter of a river god who, when pursued by Apollo, prayed for aid and was transformed into a laurel-tree.

Daphne. Grove and temple of Apollo, near Antioch, long a notorious pleasure resort.

Daphne. Genus of showy-flowered shrubs of the natural family *Thymeleaceæ*, mainly natives of tropical regions, planted for ornament.

Daphnia. Fresh-water flea, apparently similar to *Cyclops* and *Cypris*, but different in structure. The protruding head bears a pair of bold, biramous antennæ and a dancing, prominent eye, apparently situated ventral of the antennæ. There are five pairs of short feet, and the brood-pouch is formed between the back and the carapace, and bounded posteriorly by a backward process from the upturned end of the abdomen. The shell ends in a tail-like spine. See CLADOCERA.

Daphnis. Son of Hermes; taught by Pan to play the flute; regarded as the inventor of pastoral poetry.

Da Ponte, LORENZO, 1749–1838. Italian dramatist and translator, resident in N. Y. from 1805. *Hist. Florence*, 1833.

D'Arblay, MME. See BURNEY, FRANCES.

Darboy, GEORGES, 1813–1871. Bp. of Nancy 1859, Abp. of Paris 1863; a liberal prelate, murdered by the Commune 1871.

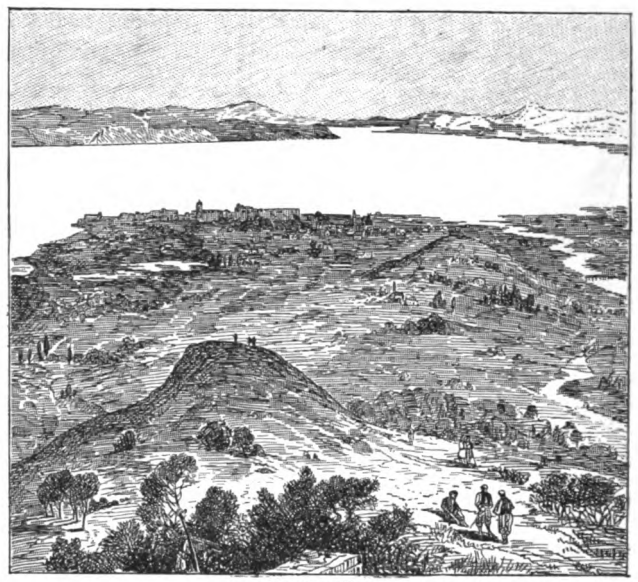
Darby, JOHN NELSON, 1800–1882. English hymnist, leader of one section of the Plymouth Brethren.

Darby, WILLIAM, 1775–1844. American geographer, who edited two gazeteers, 1823–30, and wrote on La., 1816, Fla., 1821, and other parts of the U. S.

D'Arc, JEANNE. See JOAN OF ARC.

Darcet, JEAN PIERRE JOSEPH, 1777–1844. French chemist.

Dardanelles. Anciently Hellespont. Narrow strait, ab. 40 m. long, 1 to 4 m. wide, connecting the Sea of Marmora with the Archipelago, the current being westward. Both sides of



Dardanelles.

the channel are strongly fortified. It was crossed to Europe by Xerxes on floating bridges 480 B.C.; and by Alexander to Asia 334 B.C.

Dardanus. Mythical ancestor of the Trojans, and through them of the Romans; son of Jupiter and Electra.

Dares. Mythical author of a history of the Trojan war, extant in a Latin version, made ab. 400.

Darfur. Country of n. Central Africa, ab. 10° to 16° n. lat., 25° to 28° e. long.; nominally subject to Egypt 1875–84. It is in part fertile, and is a center of the slave-trade. Area ab. 200,000 sq. m., pop. probably over 1,500,000.

D'Argenson, MARC PIERRE, COMTE, 1696–1764. French Minister of War 1743, banished 1757.

Daric. Persian coin, with a crowned archer kneeling on one knee with a bow extended, and on the reverse an incused square. Properly of gold, worth a little over $5; but coins of this pattern were also struck in silver, known as the Siglos, and came to have the same name.

Darien. First point on the Continent of America colonized by Europeans, 1509; abandoned 1519, on the founding of Panama; original name of the Isthmus of Panama.

Darien, GULF OF. Inlet from the Caribbean Sea, in Colombia.

Darien Scheme. Attempt in 1698 to found on n. side of the Isthmus of Darien a Scottish colony that should be an entrepôt for the commerce of the two oceans. The enterprise promised well, but failed because of the sickly climate, lack of supplies, refusal of other British colonies to co-operate, and opposition of the Spaniards. An interoceanic canal was included in the plans of Wm. Patterson, the projector.

Darius. I. King of Persia 521–485 B.C. He invaded Scythia, subdued Thrace and Macedonia by the hand of Megabazus, began the great conflict with Greece, was defeated at Marathon 490, and left to Xerxes extensive preparations for renewing the war.—II. Nothus, king 424–405 B.C.; father of Artaxerxes II. and Cyrus the Younger.—III. Codomannus, king 336–331; defeated at Issus by Alexander 333, and in plains of Gaugamela (Arbela) 331; slain by one of his satraps.

Darjiling. Hill-station and sanitarium in Sikkim on the first slope of the Himalayas, 7,168 ft. above sea-level. Acquired in 1835, it is the seat of the Lieut.-Gov. of Bengal for several months in the year. It commands magnificent scenery and tea is cultivated in the district. Pop. 7,000.

Dark Ages. Period variously limited, from ab. 476 or 500 to ab. 1300 or 1500.

Dark Day. That oftenest referred to occurred in New England May 19, 1780; another Oct. 21, 1816, when candles had to be lighted at dinner-time in Cambridge, Mass. Oct. 19, 1762, was strangely dark at Detroit; Oct. 16, 1783, in Canada.

Dark Heat. Rays of radiant energy, the wave-length of which is too long to affect the eye. In the solar spectrum they are beyond the red end, and so are called "ultra-red." The term is unfortunate, because radiant energy is really not heat at all, and becomes heat only after it is absorbed.

Dark Segment. Ash-colored shadow of the earth seen in e. half of the horizon just before and after sunset.

Darley, FELIX OCTAVIUS CARR, 1822–1888. American artist, noted chiefly for outline illustrations to Judd's *Margaret*, 1856, and to Irving's *Rip Van Winkle* and *Sleepy Hollow. Sketches Abroad*, 1868.

Darling. Branch of Murray R. in s. e. Australia. It heads in the mountains of Queensland and flows s. w. and s.

Darling, GRACE, 1815–1842. English heroine who, with her father, keeper of a lighthouse on the Farne Is., rescued 9 persons from a wreck, Sept. 7, 1838.

Darlington, WILLIAM, M.D., LL.D., 1782–1863. American botanist. *Flora Cestrica*, 1826–37; *Agricultural Botany*, 1847.

Darmesteter, ARSENE, 1846–1888. French philologist, of Jewish birth. With M. Hatzfeld he began a dictionary, and pub. *French Literature in 16th Century*, 1878.—His brother, JAMES, 1849–1894, prof. Col. of France 1885, was a learned Orientalist. *Ormuzd and Ahriman*, 1877; tr. *Zend Avesta*, 1883; *Prophets of Israel*, 1892.—James's wife, A. MARY F. (ROBINSON), b. 1857, is an English poet.

Darmstadt. Capital of Hesse-Darmstadt, Germany, on

Market-Place, Darmstadt.

the Darm, 15 m. s. of Frankfort-on-the-Main. Pop., 1890, 56,503.

Darnel. Grasses of the genus *Lolium*, nearly allied to Wheat, natives of the Old World, but diffused as weeds. *L. perenne* is common in e. America, and known also as Rye Grass.

Darnley, HENRY STUART, LORD, 1541–1567. Second husband of Mary queen of Scots 1565. He caused the murder of Rizzio, and was blown up, probably at the instigation of Bothwell.

Darters. 1. (*Anhingidæ*) Cormorant-like birds of Africa and America, distinguished for the length and slenderness of their bill and neck, their power of rapid swimming beneath water, and ability to capture fish. When the head projects above the water the appearance appropriately suggests the name "snake birds," by which they are often called. 2. (*Percidæ* or *Etheostomatidæ*) Small fishes, of many species, related to Perches. They lie quietly among weeds or rocks, and dart swiftly away when disturbed, to lie quiet in some other place.

Dartford. Town of Kent, at which Wat Tyler began his rebellion 1381. The first paper-mill in England was built here 1588. Pop., 1891, 11,962.

Dartmoor. In Devonshire; noted for its antiquities, and for a prison, built 1806, remodeled 1855.

Dartmouth. Seaport in s.w. England, whence the Crusaders under Richard Cœur de Lion set sail in 1190; twice burned by the French, who in a third attempt 1404 were repulsed chiefly by the women; besieged and taken by Prince Maurice 1643, and by Fairfax 1646. Pop., 1891, 6,038.

Dartmouth College. At Hanover, N. H.; chartered 1769. It grew out of Moor's Charity School for Indians, opened 1754 at Lebanon, Conn. The Chandler School of Science dates from 1851, the Thayer School of Engineering from 1871, and the Medical School from 1798. The N. H. College of Agriculture, established at Hanover 1866, was removed to Durham 1892. Dartmouth has (1895) 33 professors, 349 students (509, including medical and engineering schools), and a library of 75,000 vols. Total of graduates in arts and letters to 1890, 4,872; in medicine, 1,676; in all departments, including affiliated schools, 7,732. The medical school is officered by 11 regular and 5 special professors.

Dartmouth College Case. Argued by D. Webster 1819; decided by U. S. Sup. Ct. that a corporation charter was a contract, which could not be changed by a State legislature.

Daru, PIERRE ANTOINE NOEL BRUNO, COMTE, 1767–1829. French author and official. Peer 1818. *Hist. Venice*, 7 v., 1819–21; *Hist. Brittany*, 3 v., 1826.

Daruma. This twenty-eighth Indian and first Chinese Patriarch of Buddhism was the son of a king in Southern India. He arrived in China 520, and is said to have come to Japan in 613 and died there. The saint is often treated with irreverential humor by artists of the popular school in Japan. The Japanese tilting toy is made in the form and receives the name of this personage.

D'Arusmont, MME. See WRIGHT, FANNY.

Darwin, CHARLES ROBERT, F.R.S., 1809–1882. English naturalist, "father of modern biology." His voyage on the *Beagle*, 1831–36, led to results recorded in a Journal, 1839, *Zoölogy*, 1840–42, *Coral Reefs*, 1842, *Volcanic Islands*, 1844, and other works. From 1842 he lived near Orpington, Kent, experimenting with pigeons, flowers, worms, etc. His most celebrated books are *Origin of Species*, 1859, and *Descent of Man*, 1871. His other works deal more with details and less with broad principles:

Charles R. Darwin.

Cirripedia, 1851–53; *Orchids*, 1862; *Climbing Plants*, 1865; *Variation under Domestication*, 1867; *Expression of the Emotions*, 1873; *Fertilization*, 1876; *Power of Movement in Plants*, 1880; *Vegetable Mould*, 1881. These studies absorbed his energies; he cared little for imaginative literature, and found Shakespeare dull.—His work has been carried on by his sons, GEORGE HOWARD, LL.D., F.R.S., b. 1845, prof. Cambridge 1883, and FRANCIS, F.R.S., b. 1848.

Darwin, ERASMUS, M.D., 1731–1802. Scientist and poet, grandfather of CHARLES. He wrote in verse *The Botanic Garden*, 1791, and *Temple of Nature*, 1803, and in prose *Zoönomia*, 1793, and *Phytologia*, 1800.

Darwinism. Theory that all animals and plants are genetically related and can all (including Man) be traced back to common ancestors, primarily the Protozoan colonies which were the earliest beginnings of the *Metazoa;* also that the differentiation which produced different groups, sub-groups, and species, was due to the fact that each child varies a trifle from the type of its parents, and this in no definite direction, but that adaptation results through the "survival of the fittest," *i.e.*, by natural selection.

Dasent, SIR GEORGE WEBBE, D.C.L., b. 1820. English translator of Norse tales; ed. *Fraser's Magazine*, 1871, and *Icelandic Dictionary*, 1874.

Dash, COUNTESS. Pen-name of Gabrielle Anna Cisterne de Courtiras, Vicomtesse de Saint-Mars, 1804–1872, a French novelist. Her numerous tales treat chiefly of the illicit amours of the aristocracy. *Les Amours de Bussy-Rabutin*, 1850; *Les Aventures dûne Jeune Mariée*, 1870.

Dashkoff, Ekaterina Romanovna, Princess (*née* Voronzoff), 1743–1810. Founder and first pres. Russian Academy, 1783.

Dashour, or Dashoor. Egyptian site, 3 m. s. of Sakkarah; part of the cemetery of ancient Memphis, where are two brick and two stone pyramids.

Dash Pot. Device to retard the closure of a valve which falls to its seat by gravity. On the stem of the valve is fitted a piston, which fits the bore of a short cylinder. When the valve is lifted, air enters below the piston; when the valve drops, the air cannot escape instantly from below the piston, and so acts to cushion the fall. The escape of air can be controlled by a small cock. For heavy valves, oil is used as the retarding fluid. It is drawn in rapidly on the up-stroke through a large check-valve and fills the pot; on the drop, the check-valve closes, and the outflow of the oil takes place through an opening, which may be graduated from outside.

Dass, Peter, 1647–1708. Norwegian poet. *Song of the Valley*, 1696; *Spiritual Pastimes*, 1711; *Trumpet of Nordland*, 1759.

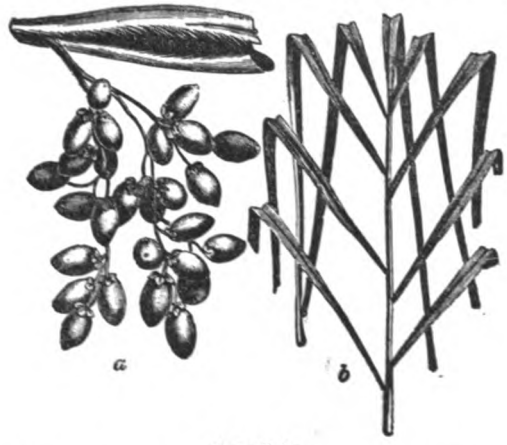
Dasycladeæ. Family of marine green Algæ of the order *Siphonaceæ*, including several genera.

Dasypodidæ. See Loricata (*Edentata*).

Dasyprocta. See Hystricomorpha.

Date. In law, time, stated in a writing, when a thing was done. It is not essential to the validity of an instrument, and may, therefore, as a rule, be contradicted by oral evidence.

Date Palm. *Phœnix dactylifera.* Tall palm, native of n. Africa, naturalized along the Mediterranean in s. Europe,



Date Palm:
a, bunch of dates dependent from their spathe; b, portion of leaf.

producing the well-known fruit, which is an important article of commerce.

Date Plum. See Persimmon.

Dathan. Reubenite chieftain of Israel, involved in the rebellion and destruction of Korah.

Datiscaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising 3 genera and ab. 4 species, growing in w. Asia, the Indian Archipelago, Java, the s. part of N. America, and s. Europe.

Datolite. $H_2Ca_2B_2Si_2O_{10}$. Hydrous calcium borosilicate, occurring as an alteration product in some eruptive rocks.

Datura. Genus of the *Solanaceæ*, common to both hemispheres, *Datura stramonium*, *D. alba*, *D. fastuosa* and other species. All parts of the plant contain atropine, a cerebro-spinal poison. See Atropine, Belladonna and Daturine.

Daturine. Identical with Atropine (q.v.).

Daub, Karl, 1765–1836. Prof. Heidelberg from 1795; speculative theologian, whose works show the influence of Kant, Schelling, and later of Hegel. *Judas*, 1816; *Dogmatics*, 1833.

Daubenton, Louis Jean Marie, 1716–1799. Buffon's helper in vols. 1–15, Natural History; encyclopedist; prof. Coll. of France 1778.

Daubentonoidea. See Prosimiæ.

Daubeny, Charles Giles Bridle, F.R.S., 1795–1867. Prof. Oxford 1822. In his *Active and Extinct Volcanoes*, 1826, he proposed the theory that the bases of earths exist in a metallic state and by their oxidation give rise to volcanic fires. *Sexuality in Plants*, 1860; *Climate*, 1862; *Trees and Shrubs of the Ancients*, 1865; *Plants of the World*, 1868.

Daubigny, Charles Francois, 1817–1878. French landscape painter, ranking after Rousseau, Troyon, Corot, Dupré, and Michel.—His son, Charles Pierre, b. 1846, is an artist of note.

Daubrée, Gabriel August, b. 1814. Prof. Strassburg 1839, Paris 1861; geologist, mining engineer; one of the first writers on Metamorphism and the genesis of Mineral structure.

Daudet, Alphonse, b. 1840. French novelist of great eminence. *Tartarin*, 1872; *Jack*, 1876; *The Nabob*, 1878; *Kings in Exile*, 1880; *Numa Roumestan*, 1882; *Sappho*, 1884; *Tartarin in the Alps*, 1885; *The Immortal*, 1888; *Port Tarascon*, 1890. He has also written plays and poems.—His brother, Louis Marie Ernest, b. 1837, is a historian and novelist.

Daulatabad. Fortress in the Deccan, ab. 200 m. n. e. of Bombay. The mean height of the town is 1,721 ft. on a conical green-stone rock scarped to a height of 120 ft. from the base. It is reached by a narrow passage excavated in the solid rock. Anciently of great importance to warring princes, it has now fallen into decay. Pop. 1,243.

D'Aulnoy, Marie Catherine Jumelle de Berneville, Countess, ab. 1650–1705. French authoress whose memoirs and romances are deservedly forgotten. Her *Contes des Fées*, however, including the White Cat, Yellow Dwarf, and others, still stand high in fairy lore.

Daumer, Georg Friedrich, 1800–1875. German poet and philosophic writer. *Mahomet*, 1848.

Daumier, Henri, 1808–1879. French caricaturist.

Daun, Leopold Joseph Maria, Graf von, 1705–1766. Austrian general; Commander-in-Chief 1757–64. He defeated

Leopold Joseph Maria Daun.

Frederic II. at Hochkirch Oct. 14, 1758, and Fink at Maxen, 1759. Subsequently important battles were gained by him.

Dauphin. Title, 1349–1830, of French king's eldest son.

Dauphiné. Part of s. e. France. It once belonged to the kingdoms of Burgundy and Arles, and to the German empire 1032–1343. It was a province governed by the dauphin 1349–1457.

Davenant, Sir William, 1605–1668. English poet, knighted 1643, and twice imprisoned as a royalist; author of an epic, *Gondibert*, and sundry plays.

Davenport. City of Scott co., Ia., on the Miss. R., opposite Rock Island, Ill.; founded 1835. Pop., 1890, 26,872.

Davenport, Edward Loomis, 1814–1877. American actor.—His daughter, Fanny Lily Gipsy, b. 1850, has been on the stage from childhood.

Davenport, John, 1597–1670. Puritan divine, one of the founders of New Haven, Conn., 1638.

David, ab. 1085–1015 B.C. King of Judah 7 years, and of all Israel 33 years; famous as warrior, poet, and religious genius, though disfigured by the vices of sensuality, jealousy, and occasional cruelty, almost inseparable from his office in the East.

David I., 1084–1153. King of Scotland 1124. He warred unsuccessfully with England, but ruled wisely at home.

David II., 1324–1371. King of Scotland; son of Robert the Bruce; crowned 1329. He fled to France soon after the defeat of the Scots at Halidon Hill, July 20, 1333; regained the throne 1342; invaded England 1346, was made prisoner and held 11 years; ruled from 1357.

David, St. Patron of Wales; 6th century. He founded monasteries and the bishopric which is named from him, and was canonized ab. 1123.

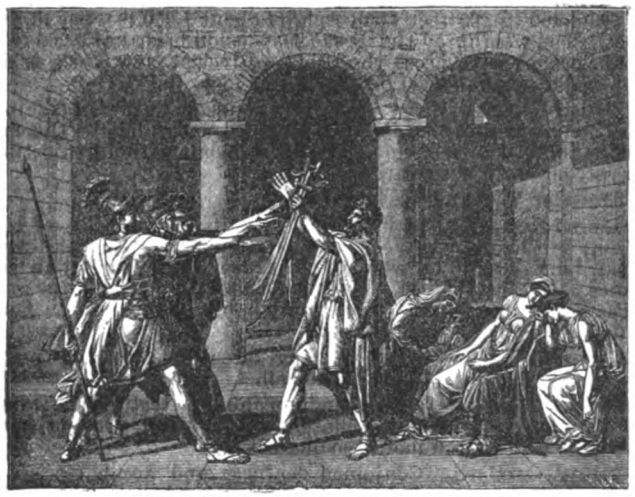
David, Felicien, 1810–1876. French composer of chamber music, symphonies, songs, pianoforte pieces, and operas; best

known by piece of programme music, *Le Désert*, which was inspired by several years' sojourn in the Orient, was produced 1844, and stands among the finest specimens of music with local color. His most successful opera is *La Perle du Brésil*, 1851. He was an enthusiastic disciple of St. Simon, and succeeded Berlioz as librarian of the Paris Conservatory.

David, FERDINAND, 1810–1873. German violinist.

David, GERHARD, ab. 1450–1523. Dutch painter; he lived at Bruges and painted principally devotional subjects. Rome, London, Bruges and Berlin possess the best examples.

David, JACQUES LOUIS, 1748–1825. Leader in France of the



Oath of the Horatii. Gallery of the Louvre.

classic revival in painting. His style is academic and his color hard, but he had talent and lofty aspiration.

David, PIERRE JEAN, called D'ANGERS, 1789–1856. French sculptor.

Davidson, ANDREW BRUCE, D.D., LL.D., b. 1831. Prof. New Coll., Edinburgh. 1863; commentator and O. T. reviser. *Hebrew Grammar*, 1874.

Davidson, GEORGE, Ph.D., b. 1825 in England. Astronomer, long connected with U. S. Coast Survey.

Davidson, JOHN, b. 1855. Scottish poet. *Ballads and Songs*, 1895.

Davidson, LUCRETIA MARIA, 1808–1825, and MARGARET MILLER, 1823–1838. American sisters, whose precocious verse was commended by Southey and Irving.

Davidson, ROBERT, D.D., 1808–1876. Historian of the Presbyterian Ch. in Kentucky, 1847.

Davidson, SAMUEL, D.D., LL.D., b. 1807 in Ireland. Biblical critic; prof. Belfast 1835, and Manchester 1842–57; O. T. reviser. *Canon of the Bible*, 1877; *Last Things*, 1883.

Davidson, THOMAS, LL.D., F.R.S., 1817–1885. Scottish paleontologist. *British Fossil Brachiopoda.*

Davidson, THOMAS, b. 1840, Scottish-American philosopher. Tr. Rosmini, 1882–84; *Aristotle*, 1892.

Davidson College. In Mecklenburg co., N. C.; founded 1837; under Presbyterian control. It has 9 instructors and 150 students.

Davies, CHARLES, LL.D., 1798–1876. Prof. Math. at West Point U. S. Military Academy 1816–37, Trinity Coll. 1839–41, and Columbia 1857–65. He pub. a series of text-books. *Logic and Utility of Math.*, 1850; *Math. Dictionary*, 1855, with Prof. Wm. G. Peck.

Davies, SIR JOHN, 1570–1626. English philosophical poet; Attorney-gen. of Ireland 1603; knighted 1607; M. P. 1620, Chief-justice 1626. His *Nosce Teipsum*, 1599, is a fine poem on immortality.

Davies, SAMUEL, 1723–1761. Pres. Coll. N. J. 1759. His sermons and hymns were highly valued.

Davies, THOMAS, ab. 1712–1785. English actor; biographer of Garrick 1780.

Davila, ENRICO CATERINO, 1576–1631. Italian historian of the *French Civil Wars* (*1559–1598*), 1630.

Davila, GIL GONZALEZ, 1570–1658. Spanish historian.

Davila y Padilla, AGUSTIN, 1562–1604. Mexican historian; Abp. of Santo Domingo 1599.

Davis, CHARLES HENRY, U. S. N., 1807–1877. Commodore 1862, rear-admiral 1863. In 1862 he had command on the Mississippi, and took Memphis, Tenn.

Davis, DAVID, LL.D., 1815–1886. Circuit Judge Ill. 1849–62: Associate Justice U. S. Supreme Court 1862–77; U. S. Senator 1877–83: Pres. Senate 1881–83.

Davis, HENRY WILLIAM BANKS, b. 1833. R. A. 1877. English landscape painter, principally of scenes in Normandy.

Davis, HENRY WINTER, LL.D., 1817–1865. M. C. from Md. 1855–61, 1863–65; prominent Unionist. *Speeches*, 1867.

Davis, JEFFERSON, LL.D., 1808–1889. M. C. from Miss. 1845–46; Colonel in the war with Mexico; U. S. Senator 1847–51 and 1857–61; Sec. of War 1853–57; Pres. Confederate States 1861–65; imprisoned 1865–67; pardoned 1868. *Rise and Fall of the Confederate Government*, 1881.

Davis, JEFFERSON C., U.S.A., 1828–1879. General of volunteers 1861–65, serving chiefly in the West.

Davis, JOHN, 1550–1605. English navigator who sought a n. w. passage to the E. Indies, and discovered Davis' Strait 1585; slain by pirates off coast of Malacca. *World's Hydrographical Description*, 1595.

Davis, JOHN, LL.D., 1787–1854. M. C. 1825–33; Gov. of Mass. 1834–35 and 1841–42; U. S. Senator 1835–41 and 1845–51.—His son, JOHN CHANDLER BANCROFT, LL.D., b. 1822, was U. S. agent at the Geneva arbitration 1870, Minister to Germany 1875–77, and Judge of U. S. Court of Claims 1877–81. *Treaties and Conventions*, 1873.

Davis, JOHN LEE, U. S. N., 1825–1889. Commodore 1882; Rear-Admiral 1885.

Davis, MATTHEW L., 1766–1850. Biographer of Aaron Burr, 1836–37.

Davis, RICHARD HARDING, b. 1864. American author and journalist. His first magazine story, *Gallegher*, was a distinct success, and was followed by others of much force, which have been collected in several volumes, 1891 and later. His later books record impressions of travel: *The West from a Car Window*, 1892; *Our English Cousins*, 1893; *Rulers of the Mediterranean*, 1894; *Princess Aline*, 1895.—His mother, REBECCA (HARDING), b. 1831, has pub. *Margaret Howth*, 1861; *Dallas Galbraith*, 1868, and other novels.

Davis, THOMAS, 1814–1845. Irish poet. His lyrics, collected 1856, include *The Geraldines.*

Davis, WALTER G., b. ab. 1860. Director Meteorological Office, Cordoba, Argentina.

Davis, WILLIAM MORRIS, b. 1850. Prof. Harvard, 1890; founder and pres. New England Meteorological Society. *Meteorology.*

Davis' Strait. Broad passage from Baffin Bay to the Atlantic, between Greenland and Baffin's Land.

Davit. Long beam used as a crane in hoisting the flukes of the anchor to the top of the bow so as to avoid injuring the side of the vessel as it ascends.

Davitt, MICHAEL, b. 1846. Irish patriot, imprisoned 1870–77 and 1881–82; founder of the Land League, 1879, and its manager; M. P. 1892.

Davoût, or **Davoust,** LOUIS NICHOLAS, 1770–1823. French General 1793; Marshal 1804; distinguished at Austerlitz, Auerstädt, and Wagram; Duke of Auerstädt 1808, Prince of Eckmuhl 1811, Peer of France 1819.

Davy, SIR HUMPHRY, LL.D., F.R.S., 1778–1829. English chemist; prof. Royal Inst., London, 1802–13; knighted 1812;

Sir Humphry Davy.

Baronet 1818. He isolated the alkali and alkaline earth metals by electrolysis, invented the safety lamp, and wrote much on mine gases. *Researches*, 1799; *Chemical Philosophy*, 1812; *Agri-*

cultural Chemistry, 1813; *Salmonia*, 1828; *Consolations in Travel*, 1830; *Works*, 9 v., 1839–40.

Davy Lamp. Constructed on the principle discovered by Davy 1815, and used in coal mines that contain fire-damp. See SAFETY LAMP.

Daw. *Corvus monedula.* Bird of the Crow family found in Europe, Asia, and Africa. It is gregarious and builds in steeples, towers, ruins, hollow trees, disused quarries and cliffs. It is ab. 13 in. long and 28 in. across the wings. It has black bill and legs, grayish white eyes, upper head and neck silvery gray, and glossy plumage, blue-black above, dusky below. It is omnivorous, mischievous, and easily tamed. It can also be taught to speak and has always been a favorite pet. Also called Jackdaw.

Dawes, HENRY LAURENS, LL.D., b. 1816. M.C. from Mass. 1857–75; U. S. Senator 1875–93.

Dawison, BOGUMIL, 1818–1872. Polish German actor.

Dawkins, WILLIAM BOYD, b. 1838. English geologist, Prof. Manchester 1874; author of numerous essays on fossil Mammalia and Archæology. *Cave Hunting*, 1874; *Early Man in Britain*, 1880.

Dawson, GEORGE, 1821–1876. English preacher and lecturer.

Dawson. SIR JOHN WILLIAM, LL.D., F.R.S., b. 1820. Canadian geologist; Principal McGill Coll., Montreal, 1855; knighted 1885. *Acadian Geology*, 1855–68; *Air Breathers of the Coal; Post-pliocene Deposits of the St. Lawrence Valley; Devonian and Carboniferous Flora of e. N. America; Earth and Man*, 1873; *Geol. Hist. of Plants*, 1888.—His son, GEORGE MERCER, LL.D., F.R.S., b. 1849, was connected with the N.W. Boundary Expedition of 1874, and has long been on the Geol. Survey of Canada, working chiefly in the n.w.

Day. Solar days not being of uniform length, and therefore not a convenient unit for estimating duration of time, the day is understood to be a mean day; *i.e.*, the length is the mean of that of the solar days throughout the year, 24 hours. On April 15, June 14, Aug. 31, and Dec. 24, the mean and apparent day practically coincide. The greatest deviations are Feb. 10, when mean noon occurs 14m. 29s. before the sun reaches the meridian, and Nov. 2, mean noon occurring 16m. 20s. after the sun's meridian passage. The civil day begins at midnight, the astronomical day at noon. The sidereal day is the interval between two consecutive meridian passages of the Vernal Equinox, and is 23 h., 56 m., and 4 s. in length.

Day, JEREMIAH, D.D., LL.D., 1773–1867. Prof. Yale 1803–17, Pres. 1817–46. *Algebra*, 1814; *Mensuration*, 1814; *Plane Trigonometry*, 1815; *Navigation and Surveying*, 1817.—His nephew, HENRY NOBLE, D.D., LL.D., 1808–1890, Prof. Western Reserve Coll., Ohio, 1840–48, pub. *Rhetoric*, 1850–67, *Logic*, 1867, and other text books.

Day, JOHN, ab. 1600. English dramatist.

Day, THOMAS, 1748–1789. English author. His *Sandford and Merton*, 1783–89, was long popular.

Day-Flower. Species of *Commelina*, showy-flowered low plants of the Spiderwort family, natives of e. America.

Days of Grace. Period allowed by law, formerly as a favor, now as a right, in addition to the time of payment named in a note or bill, generally three days. Paper payable on demand is not entitled to grace. The subject is often regulated by statute.

Dayton. City of Montgomery co., Ohio, on s. bank of the Great Miami. It has ten lines of railroad, and over 100 miles of streets. Water is supplied by pumping. Pop., 1890, 61,220.

Dayton, WILLIAM LEWIS, LL.D., 1807–1864. U. S. Senator from N. J. 1842–51; Minister to France 1861.

D'Azara, FELIX, 1746–1811. Spanish naturalist. Commissioner for delimiting Spanish and Portuguese possessions in S. America 1781. *Natural History of the Quadrupeds of Paraguay*, 1801.

Deacon. In the Anglican, Moravian, and M. E. systems the lowest order, in the Catholic the lowest sacramental order, of the ministry; in non-Episcopal churches a lay helper in church matters. The office existed from Apostolic times (Acts vi. 1–6), but its duties were various.

Deaconess. Female minister in the early Ch.; office revived in modern times and under various rules. See KAISERWERTH.

Deacon's Process. For manufacture of chlorine. It consists in passing a current of air and hydrochloric acid together over heated clay-balls saturated with copper sulphate. It has been supplanted by Weldon's Process, which gives much more satisfactory results.

Dead, PRAYERS FOR THE. Allowed by the Jews, and in a measure by the early Church; greatly developed in Eastern and Western Churches; usually discountenanced among Protestants.

Deadeyes. Blocks of wood through which the lanyards of the shrouds are reeved.

Dead-Letter Office. U. S. Post office department to which all undelivered letters and packages are sent. In 1891 they numbered 7,004,382; of these 1,843,116 were opened and returned to owners, 4,365,247 destroyed, and the rest filed for reclamation. This dead mail-matter contained money amounting to $1,832,509.64.

Dead Load. Weight of a bridge, as distinguished from the live load of teams or trains that cross it. A common bridge of from 100 to 200 feet span weighs about 1,000 lbs. per linear foot. The weight of the great suspension bridge of 3,200 feet span, proposed to cross the Hudson River at New York, is estimated at about 68,000 lbs. per linear foot.

Dead Reckoning. In navigation, calculation of a ship's position by noting the distance traveled according to the log and making allowance for currents, etc., but without resorting to astronomical observations.

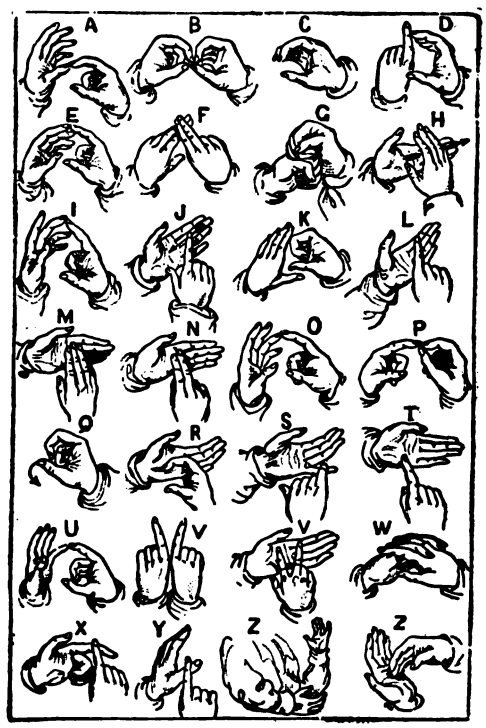
Deads. Waste rock in a mine.

Dead Sea. Called in Scripture Salt Sea, and Sea of the Plain; salt lake s.e. of Jerusalem, 1,316 ft. below the sea-level, 40 m. long, 5 to 10 m. wide, 1,300 ft. deep, and more than six times as salt as the sea. From 11,000 to 21,000 grains per gal. Area 360 sq. m. It receives the Jordan, but has no outlet. Sodom and Gomorrah were near it.

Dead Wind. Wind blowing directly from the point toward which the ship desires to sail.

Dead Work. Work done in opening or testing the value of a mine; work not immediately, or not at all, productive of ore or of coal in remunerative quantity.

Deaf Mutism. Conjoined deafness and dumbness, especially when congenital deafness prevents the learning to speak. In 1890, 41,283 persons were reported as deaf and dumb in U. S. The education of deaf-mutes was first proved possible by Cardan



Two-handed Alphabet.

(1501–76) and put into practice in Spain by Pedro Ponce (1520–84), but in England the first school was not opened till 1760 and France followed five years later. Now Great Britain has 48 schools, U. S. 61, Germany 96, France 70, Italy 35, and there are more than 100 in other countries.

Deafness. Inability to hear, due to disease of ear or cerebral disorders.

Deak. FRANCIS, 1803–1876. Hungarian statesman, leader of the Liberals 1832–48 and from 1861; his policy triumphed in 1857 in the restoration of self-government to Hungary.

Deal. Thin fir planking largely used in English carpentry. Commercially the name is restricted to timber of 6 ft. x 7 in. x 3 in. minimum measurement.

Dean. President of a cathedral chapter; head of a college, guild, or other association.

Dean, AMOS, LL.D., 1803–1868. Prof. Albany Law School 1851. *Medical Jurisprudence*, 1854; *Hist. Civilization*, 7 vols., 1868–70; *British Constitution*, 1886.

Dean, FOREST OF. In Gloucestershire, area 34 sq. m. Most of it belongs to the crown, and half of it is used to grow timber for the navy. The inhabitants, ab. 10,000, had ancient mining rights and privileges, which remain in part.

Dearborn, HENRY, 1751–1829. American officer in the Revolutionary War, and general in that of 1812; M. C. 1793–97; Sec. of War 1801–09; victor at York (Toronto) and Fort George 1813; Minister to Portugal 1822–24.

Dearth, HENRY GOLDEN, b. 1863. S.A.A. 1889. American landscape painter; winner of the Webb prize 1893.

Death. Physiologically there are two kinds of death. 1st, *Local death*, death of individual cells, which is continually going on, and 2d, *General death*, death of the body as a whole.

Death, BLACK. The plague.

Death, BROTHERS OF. French religious order, constituted 1620, and suppressed by Urban VIII. 1633. They followed the rule of St. Augustine and constantly kept the image of death before their own and each other's mind. A skull and cross-bones was embroidered on their scapularies.

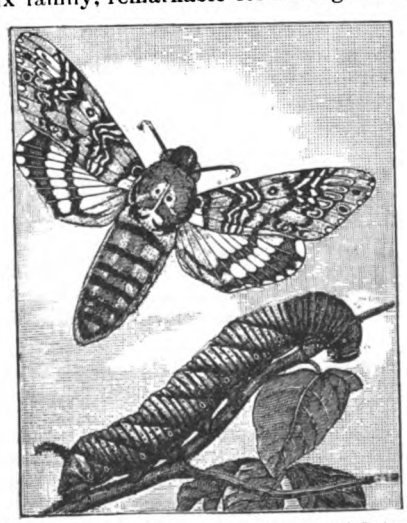
Death, CIVIL. Dispossession of civil rights. At common law it followed the outlawry or conviction for felony of a natural person, and the forfeiture of a corporation's charter. It is now regulated by statute generally. Natural death did not give cause of action at common law against one negligently causing it, to representatives of deceased; but modern statutes do.

Death-Rate. In 1890 the deaths in U. S. numbered 875,521, giving a death-rate of 13.98 to the thousand; in 1880 it was 15.09; in 1870, 12.77. Death-rate 1890, per 1,000 of each:

	White	Colored
Atlanta	18.28	33.57
Baltimore	22.61	36.41
Boston	24.62	33.29
Brooklyn	25.41	34.99
Buffalo	19.83	34.22
Chicago	21.03	23.30
Indianapolis	17.78	30.04
Nashville	14.39	23.92
New Orleans	25.41	36.61
New York	28.47	37.46
Philadelphia	22.28	32.43
Richmond	22.25	40.80
San Francisco	23.57	24.06
Savannah	29.04	41.47
Washington	19.79	38.22

Death Rattle. Sound caused by bubbling of air through mucus in the larynx and trachea; usually noted at the approach of death, but not necessarily a sign of it.

Death's-Head Moth. *Acherontia atropos.* The largest of the Sphinx family, remarkable for having the outline of a skull in yellow on a black ground. This marking, together with its strange cry, has given rise to the European superstition of its being the messenger of death. It lives chiefly on the potato-plant.



Death's-Head Moth (*Acherontia atropos*) and Caterpillar.

Death Valley. Arid salt-coated tract, 130 m. long, ab. 400 ft. below sea-level, between the Amargosa and Panamint Mts., Inyo co., Cal. It is the hottest and driest spot in the U. S., and received its name from the perishing of an emigrant party here in 1849.

Death Watch. Beetles, several species of *Anobium*. The ticking noise is a sexual call made by striking the head against wood ab. ten times per minute. These sounds are considered ominous of death by superstitious night watchers with the sick.

De Bary, HEINRICH ANTON, 1831–1888. Prof. Freiburg 1855, Halle 1867, and Strassburg 1872. *Die Mycetozoen*, 1859–64; *Champignons parasites*, 1863; *Morphologie und Physiologie der Pilze*, 1866.

Debenture. 1. Custom house certificate that holder is entitled to customs drawback. 2. Bond or written instrument acknowledging a debt, and sometimes charging it on certain property; applied to a variety of instruments.

Debenture Bonds. Certificates of indebtedness issued by moneyed corporations in a form convenient to be bought and sold as investments.

Deborah. Prophetess and judge of Israel, whom she stimulated to the great victory over Sisera (Judges iv., v.).

Debreczin. Town of Hungary, 116 m. e. of Pesth, containing a large Calvinist college. Pop., 1890, 58,952, mostly Protestants.

Debruised. In Heraldry a term expressing the restraint of any animal debarred of its natural freedom by any of the ordinaries being laid over it.

De Bry, THEODOR, 1528–1598. Printer and engraver at Frankfort-on-the-Main. He and his sons pub. an important Latin collection of *Voyages to E. and W. Indies*, 1590–1634.

Debt. At common law, the sum of money due by an express agreement: in modern law what is due from one person to another, whether money, goods or services. An action of debt lay only upon a common law debt, a judgment, or a statute penalty.

Decagon. Polygon of 10 sides.

Decagyria. Orders of plants having 10 pistils.

Decaisne, JOSEPH, 1809–1882. Director Paris Botanical Garden 1851. *Florula Sinaica*, 1834; *Tiges de gui*, 1840; *Classification des algues et des polypiers calciféres*, 1842; *Le Jardin frutier du Muséum*, 1858–67.

Decalcomanie. Transference of designs from paper to china, wood, or other materials.

Decalogue. Ten Commandments. Roman Catholics and Lutherans, following one Jewish tradition, unite in one commandment all which respects idolatry, and divide into two the prohibitions of covetousness; Greeks, Anglicans, and most Protestants, following another tradition, divide the former and unite the latter.

De Camp, JOSEPH RODEFER, b. 1858, S.A.A. 1888. American landscape painter of the impressionist school.

Decamps, ALEXANDRE GABRIEL, 1803–1860. French landscape and genre painter of great power, and fond of low tones. He had many Oriental subjects.

De Candolle, ALPHONSE. 1806–1893. Prof. of Botany at the Academy in Geneva. Author of many works on the relation of climate to plant life.

De Candolle, AUGUSTIN PYRAME, 1778–1841. Swiss botanist; prof. at Montpellier 1807–16, and then at Geneva. His *Natural System of the Vegetable Kingdom*, begun 1818, was carried on by his son, ALPHONSE, 1806–1893, and grandson, CASIMIR, b. 1836.

Decandria. Linnæan class of plants, including those having ten distinct and separate stamens, as *Rhododendron*, *Hydrangea* and *Oxalis*.

Decane. $C_{10}H_{22}$. Bpt. 173° C. Liquid hydrocarbon of the marsh gas series, occurring in petroleum, and obtained by its distillation; present also in petroleum naphtha and in burning oil.

Decapetalous. Corolla consisting of ten petals.

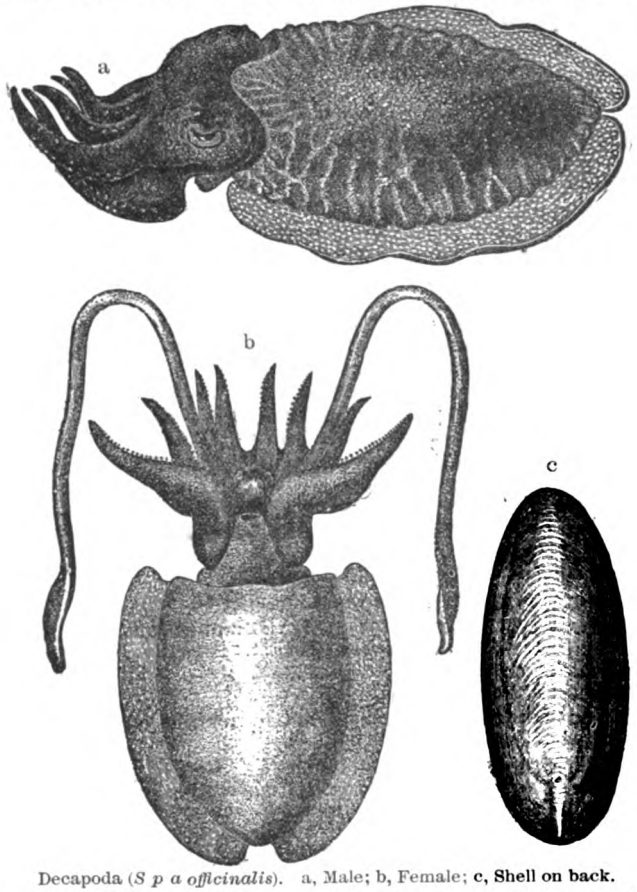
Decaphyllous. Calyx or corolla composed of ten leaves (sepals or petals).

Decapitation. Beheading was an Oriental capital punishment in remote ages and is still common in the Far East. Xenophon says that the Greeks regarded it as the most honorable death. It was rarely employed by the Egyptians, but the Romans carried it into every province. Unknown to the Anglo-Saxons, the Normans introduced it into England, where Earl Waltheof was the first to suffer by it, 1075. Ab. 1400 decapitation by ax or sword was reserved as a privilege of the nobility throughout Europe, the last instance in England being that of the rebel lords 1745. Germany, Italy and France still retain

decapitation for the extreme penalty. See GUILLOTINE and EXECUTION.

Decapoda OF CRUSTACEA. *Thoracostraca* of considerable size, with large cephalothoracic carapace, which is fused with the segments of the head and thorax. There are two or three pairs of maxillipeds, and five or six pairs of walking, thoracic legs, some of which bear chelæ. The abdomen varies, being long and well developed in the division *Macrura* (Lobsters), and rudimentary in *Brachyura* (Crabs). See ANOMOURA.

Decapoda OF MOLLUSKS. See DIBRANCHIATA. This group may be subdivided into the *Calciphora*, of which *Sepia* is an example, and the *Chondrophora*, including the *Oigopsidæ* (*Loligopsis*), and *Myopsidæ* (*Loligo*). The Cuttlefish, *Sepia officinalis*, when pursued, ejects black or brown sepia, which it carries in an ink-bag, thus concealing it from its enemies. It abounds in the Mediterranean. Specimens weighing 2 tons have been caught.



Decapoda (*S p a officinalis*). a, Male; b, Female; c, Shell on back.

Decapolis. League of ten cities in Palestine, all but one e. of Jordan, and lying in the vicinity of Pella and Gadara. Damascus is sometimes included.

Decasepalous. Calyx composed of ten sepals.

Decastyle. In classic architecture, having ten columns in front.

Decatur. Capital of Macon co., Ill., near Sangamon R. Pop., 1890, 16,841.

Decatur, STEPHEN, 1751–1808. Naval officer in Am. Revolution and 1798–1801.—His son, STEPHEN, U.S.N., 1779–1820, Commodore 1810, rendered eminent service in the wars with Tripoli 1804–5, England 1812–14, and Algiers 1815. In the last he humbled the Barbary States, freed many Christian captives, and suppressed Mediterranean piracy.

Decazes, ELIE, DUC DE, 1780–1860. French premier 1819; Envoy to England 1820–21, and to Denmark 1846.—His son, LOUIS CHARLES ELIE, 1819–1886, was Minister of Foreign Affairs 1873–77.

Deccan, or DEKKAN. S. part or peninsula of Hindustan; partly conquered by Mohammedans 1294–1325.

Deceit. Making a false statement of fact to another, with knowledge or reckless of its falsity, with intent it shall be acted on, and so acted on by the other to his damage. The victim may rescind the contract or sue for damages.

December. The Roman year began in March; December was then, as its name implies, the tenth month. Vesta presided over it. Romulus gave it thirty days, which Numa reduced to twenty-nine, and Julius Cæsar increased to thirty-one.

Decemviri. Ten annual magistrates at Rome with unlimited power, first appointed 451 B.C. to revise the laws. The second set abused their power, and the office was abolished.

Dechen, ERNST HEINRICH KARL VON, 1800–1889. German geologist and mineralogist, who studied the economic and practical side of these sciences and their application to the art of mining. *Die nutzbaren Mineralien und Gebirgsarten im Deutschen Reiche*, 1873.

Dechenite. PbV_2O_6. Lead vanadate; rare mineral.

Decidua. Mucous membrane of interior of uterus during time the latter contains an impregnated ovum. As the ovum increases in size, it becomes enveloped in folds of the membrane, which unite over it, forming the *D. reflexa;* that portion occupying the remainder of uterus is known as *D. veni*, and that beneath the ovum as *D. serotina*. See PLACENTA.

Deciduata. Section of placental mammals, in which a decidua ("after-birth") is thrown off from the uterus of the mother at birth of the young. The placenta may be either zonary or discoidal: hence we have two groups, Zonaria, including the Sub-ungulata and Carnivora, and Discoidea, including Pro-ungulata, Bats, Lemurs, and Primates.

Deciduous. Leaves which remain on a plant during a single season only, in contradistinction to persistent; also parts of the perianth of flowers which fall away after flowering and before fructification.

Deciduous Dentition ("MILK-TEETH" or CADUCOUS TEETH). First set of teeth of Mammals. Certain *Cetacea* and Edentates have no second set.

Decimal. Numbers having a scale of ten.

Decimal Fractions. Those of which the denominator is some integral power of ten; often called simply decimals. The denominator is not written, but indicated by position to the right of unit's place of the first significant figure.

Decimation. Execution of every tenth man; Roman punishment for mutiny; rarely resorted to in modern armies.

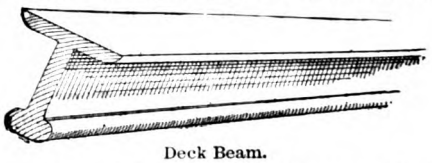
Decinormal Solution. See NORMAL SOLUTION.

Decipium. One of the doubtful elements, found in samarskite from N. C., 1878, by Delafontaine. It is said to be between the yttrium and cerium groups in properties.

Decius, CAIUS MESSIUS QUINTUS TRAJANUS. Roman emperor 249–251; defeated in a great battle with the Goths in Moesia, and slain with his son, Herennius Etruscus. His reign is memorable for a severe persecution of the Christians. He claimed descent from two illustrious plebeians, who died for Rome 337 and 296 B.C.

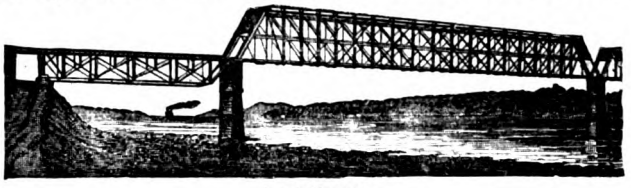
Deck. Platform of a mining cage.

Deck Beam. Wrought-iron or steel beam having a flange which sustains the weights, while the lower part is formed into a head approximately circular.



Deck Beam.

Deck Bridge. One in which the roadway is placed upon the top of the truss, as distinguished from a through bridge, in which the roadway is between the trusses. The figure shows a deck span and a through span of the Ohio River bridge at Beaver, Pa., 446 ft. long.



Deck Bridge.

Decken, KARL KLAUS VON DER, 1833–1863. German explorer of Africa. He partially ascended Mt. Kilima-Njaro 1862.

Decker, SIR MATTHEW, 1679–1749. English economist.

Decker, THOMAS. See DEKKER.

Declaration. 1. Explicit statement or acknowledgment. 2. Formal statement by the plaintiff, in a common law action, of his cause of action.

Declaration of Independence. Document announcing the separation of the American colonies from England. It

was moved in Congress June 7, 1776, that "the united colonies are, and of right ought to be, free and independent States." A committee of Jefferson and four others were appointed to prepare this declaration. It was unanimously adopted July 4 and signed Aug. 2. See MECKLENBURG.

Declaration of Paris. Statement of international rules promulgated by the Congress of Paris 1856, which have been adopted by most great powers, except the U. S., (1) abolishing privateering; (2) making the neutral flag a protection to all goods not contraband; (3) exempting neutral goods except contraband from capture, even under an enemy's flag; and (4) requiring blockades to be effective in order to be binding.

Declaration of Right. Document assented to by William and Mary upon their accession to the British crown Feb. 1689. Its substance, as contained in the Bill of Rights, forms an important part of the British Constitution.

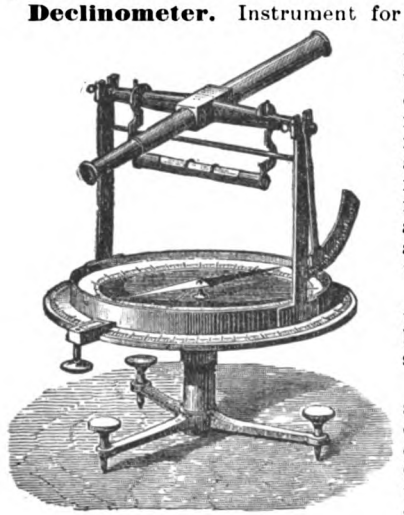
Declaration of War. Formal announcement that war is to be waged between two or more nations. It is not required by modern international law. The publication of a manifesto for the information of its subjects and of neutrals is customary on the part of the nation beginning hostilities.

Declensions. In Grammar, various groups in which are classed nouns, adjectives, or pronouns, having similar case-endings. English has no proper declension, having no case-inflection except the genitive. Languages with many cases, as Sanskrit (8), Greek (5), Latin (6), Finnish (15), and Magyar (20), have many declensions.

Declination. Distance of a star from the equator, measured on a great circle of the celestial sphere passing through the star and perpendicular to the equator. See CELESTIAL COORDINATES.

Declination of the Needle. Deviation of the magnetic needle from the true meridian. This is different in different localities, the needle pointing westward of the meridian on the Atlantic coast of the U. S., and eastward on the Pacific slope. The declination at any place slowly changes from year to year, making a complete cycle, and returning to its original value in ab. 250 years. On the Atlantic coast the minimum value of the declination occurred soon after 1800; the maximum value will occur ab. 1925. The annual variation was discovered by Cassini 1780 and is only 15′ to 18′. The diurnal changes were first observed by Graham 1722; they are most rapid in the warmest part of the day. The amplitude decreases from the poles toward the equator; *i.e.*, from 15′ or 20′ to 3′ or 4′. If the points on the earth at which there is no declination be joined by a curved line, this is called an Agonic Line. Lines on the earth along which the declination does not change are called Isogonic Lines.

Declinometer. Instrument for determining the magnetic declination of a place. It resembles a theodolite, and consists of two parts, a magnetic needle for fixing the magnetic meridian, and a telescope for determining the geographical meridian. Both are movable about the same vertical axis, which is provided with a graduated circle.



Declinometer.

Decoction. In medicine, preparation made by boiling a vegetable substance in water.

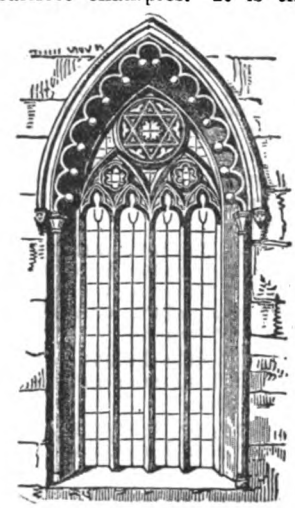
Decolorimeter. Instrument to test the decolorizing power of charcoal in a divided state. Consists of a graduated tube charged with a test solution of indigo or molasses.

Decomposition. Broadly, breaking up of bodies into their constituents; in more restricted sense, putrefaction or disintegration of albuminoids with formation of carbonic acid gas, water, ammoniacal salts, sulphuretted hydrogen, carbolic, butyric and valerianic acids, and a number of less important compounds, such as indol and skatol. Offensive odors are present as a rule and are due principally to sulphur and phosphorous compounds. Process is due to micro-organisms and does not occur when they are absent; numerous ptomaines are formed whose effects are more or less hurtful to man. It may be prevented by keeping objects at very low or high temperature, or after sterilization, in air-tight receptacles, by use of preservatives such as salt or sugar, or of disinfectants. Process begins shortly after death of animal tissues, but proceeds slowly below 40° F., but is hastened by heat and moisture.

De Coninck, PIERRE LOUIS JOSEPH, b. 1828. French genre painter. Legion of Honor 1889. *At the Fountain*, in the Wolfe Collection, N. Y.

Decorated Style OF GOTHIC ARCHITECTURE. This style flourished in England between the Early English and Perpendicular, during the last quarter of the 13th century and most of the 14th. The Crosses raised by Edward I. to his wife Eleanor are among the earliest examples. It is the most

Niche, Walpole St. Andrews, Norfolk, 14th century.



Window, Broughton, Oxfordshire, 1300.

beautiful development of Northern Gothic. In this style the ornament is not merely extraneous but becomes part of the construction and enters functionally into the style. Its characteristics are the richness of its geometric figures, window-tracery being highly decorated with foliations and cusps, and a general lavish disposition of small ornamental adjuncts.

Decoration Day. May 30, observed in commemoration of those soldiers and sailors who fell in the Civil War, by addresses, processions, and the decking of their graves with flowers; at first known as Memorial Day.

Decorative Art Movement. The studies of historic art, first carried on in a critical spirit in the late 18th and early 19th centuries, developed 1850 a strong sentiment in favor of the style and spirit of historic ornament as compared with modern. The resulting movement was originally, and still is essentially, an effort to revive the true principles of ornament, so well observed in the past. The leader of this movement in England was Owen Jones, whose *Grammar of Ornament*, 1856, has been the main standard of appeal in such matters. The South Kensington Museum in London has been an important center of this movement.

Decreasing Function. One which decreases as its variable or variables increase, as $u = \frac{a}{x^2}$.

Decreasing Series. One in which each term is less than the preceding.

Decree. Judgment of admiralty, equity, or probate court.

Decrement. In calculus, a quantity subtracted from a variable to find the preceding state of a function: term no longer used, the relation being indicated by a negative sign attached to the change.

Decrepitation. Crackling sound emitted by many crystallized substances when heated; usually due to the fact that, in forming, the crystal has inclosed some of the mother liquor; this on being heated is converted into steam, and a series of slight explosions ensue.

Decrescendo. Musical term demanding a gradual decrease in volume of sound. It is usually written *Dec.*, or *Decres.*, or marked by the sign >. *Diminuendo* has the same signification.

Decrescent. Heraldic term signifying a representation of the moon in decline from the full to the last quarter with horns directed to the sinister side of the shield.

Decretals. Collections of Canon Law, approved 1580, with later additions.

Decretals, FALSE. See PSEUDO-ISIDORIAN DECRETALS.

Decurio. Roman commander of ten horsemen, later of thirty; also, magistrate of a free provincial town.

Decussation. Crossing of similar structures so as to form a X-shaped figure, as in the case of optic nerves which cross each other so that fibers from left side of brain pass to right eye and vice versa.

Dedication. Devotion of property, as a highway, invention, or uncopyrighted book, to public use.—Setting apart a thing or person (as a church building) to sacred use.—Compliment to a patron or friend, prefixed to a book; much in vogue 1600-1750.

Dedication, FEAST OF. Annual commemoration of the cleansing of the Jewish temple, 164 B.C., after its pollution by Epiphanes.

Deduction. Process of reasoning in which the conclusion necessarily follows from the premises; hence it occurs either in the conversion of propositions or in the use of the syllogism. It is the method of proof or demonstration. In philosophy it is also sometimes used to denote the derivation of a truth from something more fundamental than itself.

Dee, JOHN. 1527–1608. English alchemist, imprisoned 1555. He lived much abroad, and received benefices from Edward VI. and Elizabeth.

Deed. Written instrument sealed and delivered; its parts when filed at Common Law are the premises or recitals; the habendum and tenendum or statements of the interest and tenure; the reddendum, or reservations; the conditions, warranties and covenants.

Deems, CHARLES FORCE. D.D., LL.D., b. 1820. Pastor in N. Y. since 1866; founder and pres. Am. Institute of Christian Philosophy, 1881.

Deemsters, or DEMPSTERS. Two chief judges in Isle of Man; celebrated in Hall Caine's novels.

Deep-Sea Soundings. Much new knowledge of the animal life and temperature of ocean depths has recently been gained. In the Atlantic the greatest depth so far found was 3.875 fathoms, just north of the Virgin Is. In the N. Pacific, between the Admiralty Is. and Japan, 4,575 fathoms was found, and in the S. Pacific, 23° 40′ S. lat., 175° 10′ W. long., an incomplete sounding was made, the line breaking at 4,900 fathoms. See BATHOMETER.

Deer. For the characteristics of the Deer Family see CERVIDÆ; also special heads as follows: CARIBOU, ELK, IRISH ELK,

Royal Stag.

MOOSE, MULE DEER, MUNTJAC, MUSK DEER, RED DEER, ROE DEER, STAG, VIRGINIA DEER, WAPITI.

Deerberry. *Vaccinium stamineum.* Low shrub of the natural family *Ericaceæ*, native of the e. U. S. Known also as Squaw Huckleberry.

Deerfield. In Franklin co., Mass.; scene of a massacre Sept. 18, 1675, when 85 men were caught in ambuscade by the Indians, and nearly all put to death. Again, March 1, 1704, the French and Indians fell upon the place, burned it, killed 47, and carried off 112 captives.

Deer Grass. See MEADOW BEAUTY.

De Facto. Actual relation, possession or status in distinction to one sanctioned by law or de jure.

Default. Non-performance of an obligation, or failure to exercise a right within the prescribed period.

Defeasance. Collateral deed or provision for the defeat of the principal deed or agreement, upon the performance of specified conditions.

Defective Hyperbola. Algebraic curve of the third degree, having two infinite branches and but one rectilinear asymptote. Its rectangular equation has the form $xy^2 + ey + ax^3 - bx^2 - cx - d = o$.

Defendant. One against whom an action is brought.

Defender of the Faith. Title bestowed on Henry VIII. by Leo X. 1521, earned by Henry's tract against Luther; afterward recalled, but still borne by sovereigns of England.

Defense. In fortification, all works erected to resist an enemy's attack in force; the garrison and armament are the personnel and materiel of the defense. When designed to offer an active defense, ample communications for the outward passage of troops are arranged to facilitate strong counter attacks against the besiegers, while for a purely passive defense the main reliance is placed upon the natural and artificial strength of the fortified place, so that the resisting power of the garrison may not be sacrificed by the losses attending active operations beyond the defended limits.

Defensive Affections. Irascible feelings, in as far as they act as a defense against harm or wrong, as resentment or indignation.

Deferent. In the astronomical system of Ptolemy each planet was supposed to move in a small circle called the epicycle; the center of this describing a circle about the earth was called the deferent. By this means the apparent irregularities of the planetary motions were explained.

Deffand, MARIE DE VICHY-CHAMROUD, MARQUISE DU, 1697–1780. French writer. *Letters to H. Walpole and Voltaire*, tr. 4 v., 1810.

Deficient Number. One greater than the sum of its aliquot parts; distinguished from abundant and from perfect number.

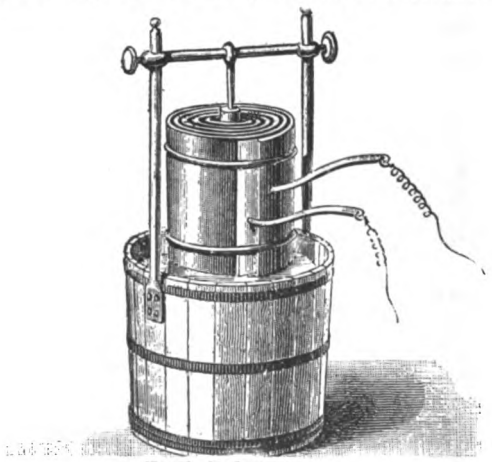
Defile. Narrow or contracted passage through or over which troops are obliged to pass; *e.g.*, a bridge, ford, mountain pass, or road through a forest.

Definite Inflorescence. See CYMOSE.

Definition. Technical process which specifies the genus and differentia of a conception so as to use these as its exact equivalent in an argument.

Definitions of Rights. Determination of the rights of men by the positive law of the community in which they live, reducing to definiteness and detail the general and fundamental rights of mankind.

Deflagrator. Form of battery devised by Robert Hare, consisting of two large sheets of copper and zinc rolled in a spiral, separated by leather, and placed in a tub of dilute acid.



Hare's Deflagrator.

The heating effect of such a battery is very great and its results in deflagrating wires and leaves of metals are most brilliant.

Deflection Angle. Angle by which a point on a curve

deviates from the tangent at another point. In railroad surveying it is the angle of deviation when the chord joining the two points is 100 ft. long.

Deflection of Beams. Amount by which a beam sinks under the action of its load. This varies directly as the load and as the cube of the length, and inversely as the breadth and cube of the depth of a beam; *e.g.*, if a beam 10 ft. long, 2 in. wide, and 6 in. deep, deflects one-sixteenth of an inch under a load of 5,000 lbs., a beam of double the length and of the same width and depth will deflect one-half an inch under the same load; if, however, both width and depth be also doubled, it will deflect only one-eighth of an inch.

De Foe, DANIEL, 1661–1731. English author, at first of political and other tracts. *The True Born Englishman*, 1701, was a satire in verse. His *Shortest Way With Dissenters*, 1703, brought him to the pillory and to prison. He ed. *The Review*, 1704–13, wrote a *History of the Union* (with Scotland), 1709, and was for a time employed by government, but in 1713 was again imprisoned and fined £800. Besides the immortal *Robinson Crusoe*, 1719, he pub. *Captain Singleton*, 1720; *Memoirs of a Cavalier*, 1720; *Moll Flanders*, 1721; *Journal of the Plague*, 1722; *Colonel Jack*, 1722; and *Roxana*, 1724. He is the father of the realistic novel.

Defoliation. Falling away of leaves from the stem, by means of an articulation at their bases, leaving a scar.

De Forest, JOHN WILLIAM, b. 1826. Am erican novelist *History of Indians of Conn.*, 1853; *Seacliff*, 1859; *Miss Ravenel's Conversion*, 1867; *Overland*, 1871; *Irene*, 1879.

Deformities. Abnormalities of shape or structure of a part. They may be congenital, as hare-lip, club-foot, etc.; result of disease, as curvatures of spine caused by destruction of vertebræ, contracture of muscles after paralysis, etc.; or result from accident or operation destroying tissue, as contracting scars.

Defreggar, FRANK, b. 1835. Tyrolese painter; prof. in Munich Academy.

Degeneration. In Biology, return of unused organs to a rudimentary state. Most parasitic species illustrate this to marked degree, some parasitic barnacles becoming reduced to mere sexual organs. In psychology, it is due to abnormal development of appetites, especially the sexual.

De Gérando, JOSEPH MARIE, BARON, 1772–1842. French soldier, philosophical writer, philanthropist and statesman. Academician 1804, Baron 1837, Vice-pres. of the Council of State 1842. *Histoire de Philosophie*, 1803; *Le Visiteur du Pauvre*, 1820; *Du Perfectionnement Moral*, 1824.

De Giers, NICHOLAS CARLOVICH, 1820–1895. Russian diplomatist; Foreign Minister from 1882.

Deglutition. Act of swallowing.

De Goeje, MICHAEL JAN, b. 1836. Prof. Leyden; Orientalist.

Degradation. Ceremony which reduces a priest or bishop to the grade of a layman, though leaving him the indelible character of his order.

Degras. Recovered grease, produced from oil tanning processes, and from the waters used in wool scouring. A mixture of greases used in tanning.

Degree. In the measurement of circular arcs, one three hundred and sixtieth of a circumference; in angle measure, one ninetieth of a right angle.

Degree of a Curve. Angle at the center of the circle, subtended by a chord of 100 feet. A one-degree curve has a radius of 5,730 feet; a ten-degree curve, of 574 feet. Railroad curves have usually a less curvature than ten degrees, although some sharper ones exist. At Mauch Chunk, Pa., on the Lehigh Valley R. R., is a fourteen-degree curve. On elevated and electric roads much sharper curves are used.

Degree of an Expression. Determined from the term having the largest number of unknown or variable factors, and representing the number of such factors. $xy + ax - by + c = 0$ and $x^2 + y^2 + ax + by - c = 0$ are of the second degree. It may vary with the change of the quantity considered as its germ. $y^3 + ax^2y^2 + bx + cy + m = 0$ is of the second degree in x, of the third degree in y, and of the fourth degree in general.

Degrees. Previous to the incorporation of academies as universities the distinctions were only of masters and scholars. Masters and Doctors are mentioned 826. Gregory IX. (1227–41), instituted the inferior order of Bachelors. Degrees in law date from 1149, medicine 1384, and music 1463.

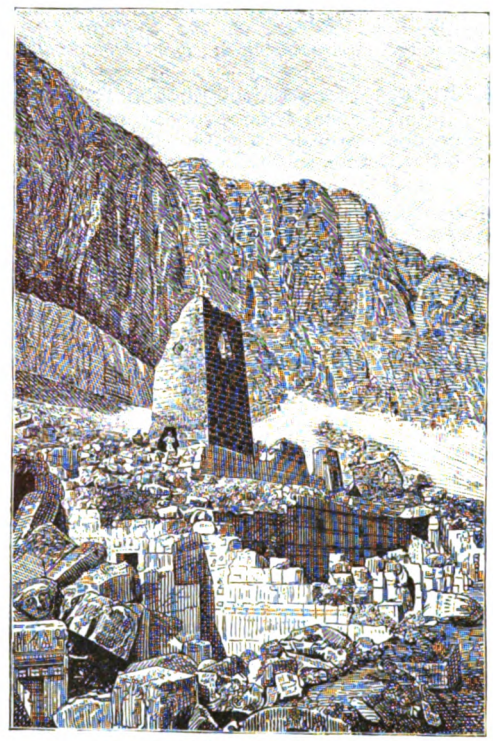
De Gubernatis. See GUBERNATIS.

De Haas, MAURICE FREDERICK HENDRICK, b. 1832. Dutch-American marine painter.

De Haven, EDWIN J., 1819–1865. U. S. naval officer, commanding expedition sent from New York in search of Sir John Franklin 1850.

Dehiscence. Opening of a seed-vessel or pericarp, allowing the seeds to escape, as in the splitting of a pea-pod.

Dehr el Bahri. Site at Thebes, bordering the desert mountains w. of the Nile, of a necropolis and a temple built by Queen Hatason, XVIIIth Dynasty. The ruins of the temple



Dehr el Bahri.

are in process of excavation with interesting results. Here the mummies of Rameses I. and II. and other Egyptian kings were found 1881.

Dei Gratia. Style assumed by bishops at Ephesus 431 as an expression of reliance on the Deity, but by European rulers as a claim of divine right to govern independently and absolutely. It was adopted by the Carlovingian kings, 9th century; by popes, 13th century; by William II. of England on his Great Seal, and by Edward III. on his gold coins. European kings generally assumed to reign "by the grace of God" ab. 1440.

Deinarchus, b. 361 B.C. Athenian orator.

Deinolochos, 6th century B.C. Greek comic poet.

Deinosauria. See DINOSAURIA.

Deinotherium. See DINOTHŒRIUM and ELEPHANT.

Deipnosophists. Greek work of ATHENÆUS (q.v.), ab. 200.

Deira. Early kingdom of n. Anglia, joined to Bernicia to form Northumbria under Ella, 560–587; later a W. Saxon earldom.

Deism. Theory which maintains, first, that the divine existence and providence can be sufficiently established without a supernatural revelation, and second, that God is a transcendent rather than an immanent power in nature. Its most notable school was English, and began with Lord Herbert, ab.1620.

Dejanira. Wife of Hercules, who caused his death through the poisoned tunic of the centaur Nessus.

Dejazet, PAULINE VIRGINIE, 1797–1875. French actress, prominent and popular till 1868.

De Kalb, JOHANN, BARON, 1721–1780. Bavarian-French general, who accompanied Lafayette to America, served in Pa., N. J., and S. C., and led the Md. and Del. troops at the battle of Camden, where he was fatally wounded.

De Kay, CHARLES, b. 1848. American poet and critic, grandson of J. R. Drake; Consul-gen. at Berlin 1894. *Hesperus*, 1880.—His uncle, JAMES ELLSWORTH, M.D., 1792–1852, was botanist and zoölogist of the N. Y. Survey of 1836.

Dekker, THOMAS, ab. 1577–ab. 1638. English dramatist. *Fortunatus*, 1600. His *Satiromastix*, 1602, attacked Ben Jonson.

De Koven, REGINALD, b. 1859. American composer, chiefly of comic operettas. *The Begum*, 1887; *Don Quixote*,

1889; *Robin Hood*, 1890; *Fencing Master*, 1892; *Knickerbocker*, 1893; *Algerian*, 1893; *Rob Roy*, 1894; *Tzigane*, 1895.

De la Bastie Glass. Glass which when red-hot has been annealed in heated oil or paraffin. This makes it very hard and elastic. Lamp chimneys made from it cannot easily be broken. Invented by De la Bastie ab. 1874.

De la Bêche, Sir Henry Thomas, F.R.S., 1796–1855. English geologist, knighted 1853. He promoted the study of economic geology, and established the Museum of Practical Geology in London. *Report on the Geology of Cornwall, Devon, and West Somerset*, 1839; *The Geological Observer*, 1851.

Delacroix, Ferdinand Victor Eugene, 1799–1863. French historical painter; leader of the revolt against the classic art of David, and one of the most gifted of modern artists. He has important paintings in the Louvre and other French museums, and several in the U. S.

Delafield, Edward, M.D., 1794–1875. Prof. N.Y. Col. Physicians and Surgeons 1825, and its pres. 1858.—His brother, Richard, U.S.A., 1798–1873, was Chief of Engineers 1864.

Delafosse, Gabriel, 1796–1878. Prof. Mineralogy in Paris Museum of Natural History.

Delafossite. Rare copper and iron oxide, found in Siberia.

Delagoa Bay. In s. e. Africa, lat. ab. 20° s.; discovered

Delagoa Bay.

1498. The territory was claimed 1868 by England, Portugal, and the Transvaal, and passed 1878 to Gt. Britain.

De la Hire, Philippe, 1640–1719. French mathematician. *Graphical Methods*, 1673; *Conic Sections*, 1685; *Epicycloids*, 1694; *Roulettes*, 1702; *Conchoids*, 1708.

Delambre, Jean Baptiste Joseph, 1749–1822. Mathematician and astronomer; Prof. Coll. of France, 1807. *History of Astronomy*, 6 vols., 1817–27.

Delamination. Splitting off of an internal layer of cells from an external one, as in the planulæ of many Cœlenterates, by which the single layer of cells of the blastula becomes two-layered, thus introducing the gastrula stage of the development.

Deland, Mrs. Margaret Wade (Campbell), b. 1857. American novelist and poet. *The Old Garden*, 1886; *John Ward, Preacher*, 1888; *Florida Days*, 1889; *Sidney*, 1889; *Story of a Child*, 1892; *Mr. Tommy Dove*, 1893; *Philip and His Wife*, 1894.

Delane, John Thaddeus, 1817–1879. Ed. London *Times*, 1841–77.

Delano, Columbus, LL.D., b. 1809. M.C. from Ohio 1845–47, 1865–69; Sec. Interior 1870–75.

Delany, Mrs. (Mary Granville), 1700–1788. In her own day her flower-work was very fashionable, but her fame rests on the court and literary gossip of her *Autobiography and Correspondence*, 6 vols., 1861–62.

De La Ramé, Louisa ("Ouida"), b. 1840. English novelist of French lineage, living chiefly at Florence. *Held in Bondage*, 1863; *Strathmore*, 1865; *Under Two Flags*, 1867; *Idalia*, 1867; *Signa*, 1875; *In Maremma*, 1882; *Wanda*, 1884; *The Silver Christ*, 1894.

Delaroche, Hippolyte (Paul), 1797–1856. French historical painter.

De la Rue, Warren, Ph.D., F.R.S., 1815–1889. English astronomer and patron of science, who acquired a large fortune in the manufacture of paper. His scientific specialties were solar physics and celestial photography.

Delaunay, Charles Eugene, 1816–1872. Director of the Paris Observatory from 1870. His most important contribution to Astronomy is his lunar theory.

Delaunay, Jules Elie, 1828–1891. French portrait and figure painter.

Delaunay, Louis Arsene, b. 1826. Actor, connected with the Théâtre Français 1848.

Delavigne, Jean Francois Casimir, 1793–1843. French poet and dramatist. *Sicilian Vespers*, 1819; *Comedians*, 1821; *Marino Falieri*, 1829; *Louis XI.*, 1832; *Don John of Austria*, 1835.—His brother Germain, 1790–1868, was also a playwright.

Delaware. One of the Eastern States, and the smallest except R. I.; area, 2,050 sq. miles. Its surface is extremely level, being in few places more than 200 feet above tide. Its surface geology shows a succession from north to south of Cretaceous, Neocene and Quarternary deposits. It has some manufactures, but its principal industry is market gardening. It had, in 1892, 320 miles of railroad. Pop., 1890, 168,493, being 81.2 inhabitants per sq. mile. The foreign element was small; the colored numbered 29,022. The capital is Dover, and the principal city Wilmington. It was colonized 1630 by the Dutch, and 1637 by the Swedes and Finlanders, who named the region New Sweden. On the cession of N. Y. to the English 1664, it was claimed by the Duke of York, and also for Md. by Lord Baltimore, but was purchased 1685 by Wm. Penn, and governed as part of Pa. It entered the Union 1776 as one of the thirteen original States. Though a slave-holding State, it did not secede 1861. (See Map on page 18.)

Delaware, or **De la Warre,** Thomas West, Lord, d. 1618. Gov. of Va. 1609.

Delaware Bay. Deep indentation into the e. coast of the U. S., between N. J. and Del.

Delaware College. At Newark, Del. It has 12 instructors, and offers courses in Arts, Agriculture, and Engineering.

Delaware Indians. Of Algonquin stock, with whom William Penn made his celebrated treaty. Gradually driven West; sided successively with French and English and joined Confederacy; defeated by Wayne on the Maumee 1794. Now scattered and mostly in Indian Terr., in 1890, 849.

Delaware River. Heads in s. N.Y., forms the e. boundary of Pa., flows generally s. into the head of Delaware Bay, and is navigable to Trenton, N. J. Drainage area 11,362 sq. m., length above Trenton 280 miles.

Delbrück, Bernhard, b. 1842. Prof. at Jena; comparative philologist.

Del Credere Commission. Additional rate paid to an expert who guarantees to his principal the performance by the purchaser of his contracts.

Delegation. Former governing court in Lombardy, Venice, and the Papal States.

Delescluze, Louis Charles, 1809–1871. French agitator, imprisoned 1853, and in Guiana 1857–59; ed. Reveil 1868; a leader in the Commune; killed on the last barricade. *De Paris à Cayenne*, 1867.

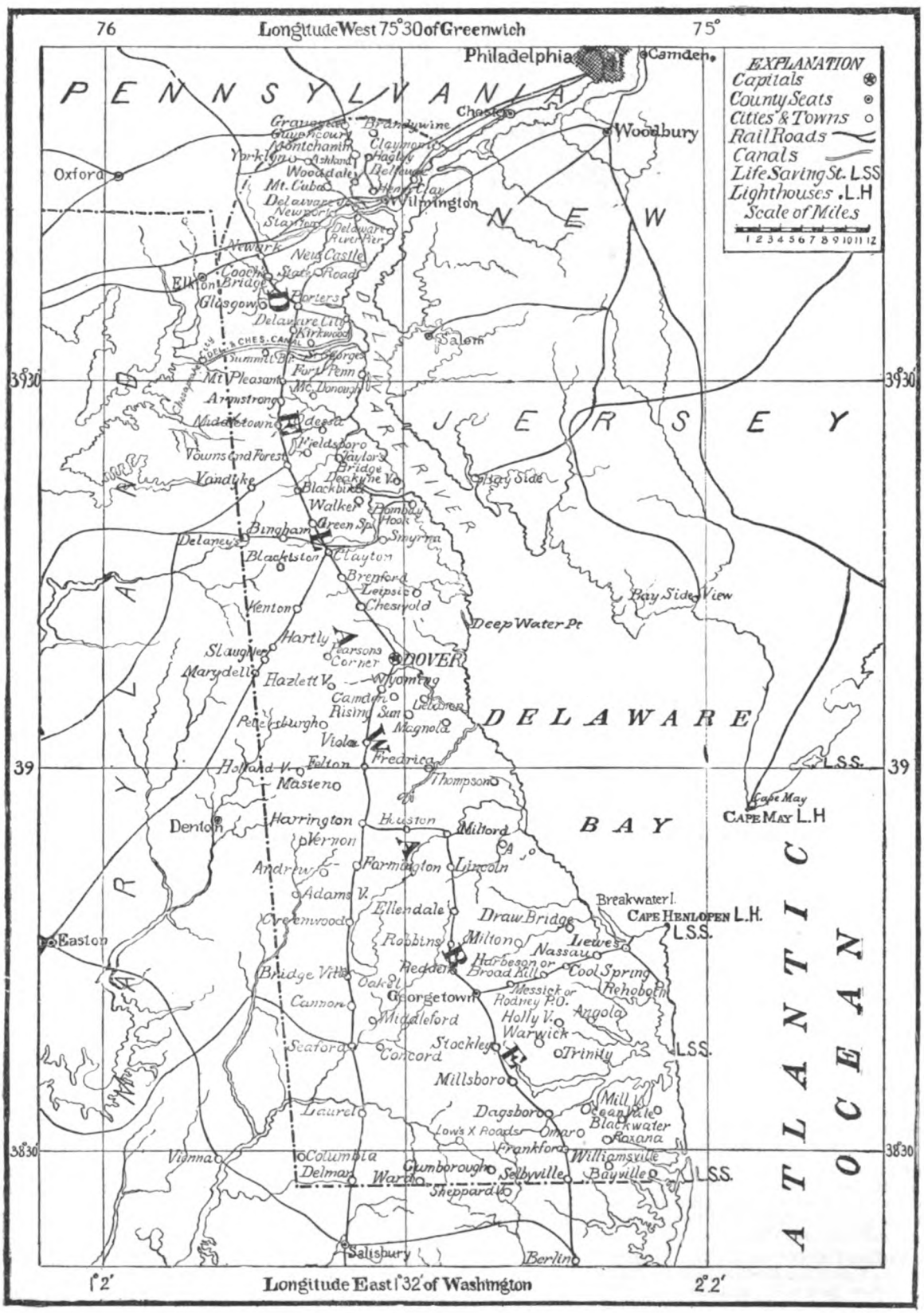
Delessite. Ferruginous chlorite.

Delezenne's Circle. Instrument for showing the existence of terrestrial induced currents. It consists of a coil of wire, ab. two feet in diameter, fixed to an axis about which it can turn by a handle. The axis itself is fixed in a frame and capable of taking any position. If the ends of the wire be attached to a galvanometer and the coil be moved so as to cut the lines of force of the earth's field, a current will be indicated. By means of a suitable commutating arrangement a continuous rotation of the coil may produce a current of constant direction through the galvanometer.

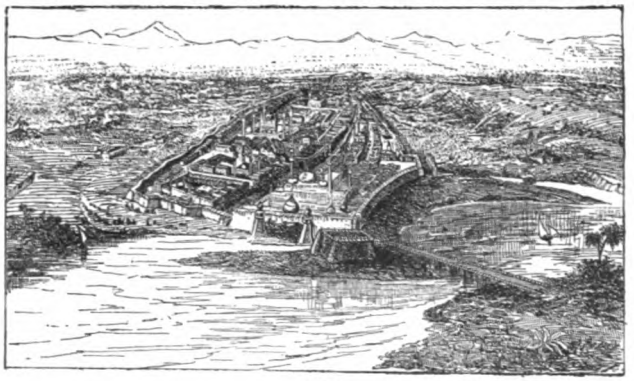
Delfshaven. Town of s. Netherlands on the Meuse near Rotterdam It has some maritime commerce, but is chiefly noted for the embarkation here of the Pilgrim Fathers 1620. Pop. 13,138.

Delft. Town of Holland, on the Schie, 8 m. n.w. of Rotterdam; formerly celebrated for its earthenware. William the Silent was murdered here 1584. Pop., 1891, 29,022.

Delhi. City of n. India on the Jumna; probably founded by Aryans ab. 1500 B.C. An inscription on an iron pillar of 3d century records the deeds of Bájá Dháva. The Tomára or Tuár dynasty was founded 763. Prithivi Rája was the last Hindu ruler. The Mohammedans of Ghor, founders of the Afghan Empire, invaded India 1191. Kutab-e-deen, general of Muhammed of Ghor, 1193, founded the dynasty of slave kings, to which D. owes its grandest architectural remains. It was followed 1288 by that of Ghilzái. The Taghlak dynasty succeeded 1321. Its founder built a new capital, 4 m. e. His grandson again changed the site. Tamerlane captured D. 1398 and massacred the inhabitants. The Taghlak dynasty was succeeded


76
Longitude West 75°30 of Greenwich
75°
Philadelphia
Camden
EXPLANATION
Capitals
County Seats
Cities & Towns
Rail Roads
Canals
Life Saving St. L.S.S.
Lighthouses L.H.
Scale of Miles
1 2 3 4 5 6 7 8 9 10 11 12
PENNSYLVANIA
Chester
Woodbury
Oxford
Wilmington
NEW
Newark
New Castle
Elkton
Glasgow
Porters
Delaware City
Kirkwood
Salem
Mt Pleasant
Armstrong
Middletown
Odessa
Fieldsboro
Townsend Forest
Taylors Bridge
Deakyne V.
Vandyke
Blackbird
Walker
Bombay Hook
Green Sp.
Smyrna
Bingham
Delaney's
Blackiston
Clayton
Brenford
Leipsic
Chesswold
Kenton
Hartly
Slaughter
Marydell
Hazlett V.
Parsons Corner
DOVER
Wyoming
Camden
Rising Sun
Lebanon
Magnolia
Petersburgh
Viola
Fredrica
Holland V.
Felton
Masten
Thompson
Denton
Harrington
Houston
Milford
Vernon
Andrew
Farmington
Lincoln
Adams V.
Ellendale
Draw Bridge
Greenwood
Robbins
Milton
Lewes
Nassau
Harbeson or Broad Kill
Cool Spring
Bridge Ville
Oakel
Redden
Georgetown
Messick or Rodney P.O.
Rehoboth
Cannon
Middleford
Holly V.
Angola
Warwick
Seaford
Concord
Stockley
Trinity
Millsboro
Laurel
Dagsboro
Mill V.
Ocean Vale
Blackwater
Low's X Roads
Omar
Roxana
Frankford
Williamsville
Vienna
Columbia
Delmar
Ward
Gumborough
Selbyville
Bayville
Sheppard V.
Salisbury
Berlin
Bay Side
Bay Side View
Deep Water Pt
Breakwater I.
CAPE HENLOPEN L.H.
L.S.S.
Cape May
CAPE MAY L.H.
DELAWARE RIVER
DELAWARE BAY
ATLANTIC OCEAN
MARYLAND
39°30'
39
38°30'
1°2'
Longitude East 1°32' of Washington
2°2'

by the Sayyids 1412–44, and the Lodi 1444–1526; the capital was removed to Agra. Baber the Tartar destroyed the Afghan Empire 1526. Baber's son, Humáyun, removed the capital to D., which was restored by Shah Jahan ab. 1638. The Mogul Empire reached its height under Aurungzebe (d. 1707). In 1739 the



Delhi.

Persian king, Nádir Sháh, captured D., massacred 60,000, and carried thence an immense treasure, including the famous peacock throne. The Mahrattas took possession of D. 1788. In 1803 Lord Lake overthrew the Mahrattas, and D. came under British rule. It was seized by the rebels 1857, and retaken by assault Sept. 20. It is now a prosperous commercial town, and a railway center. Pop., 1891, 193,580.

Delhi Boil. Ulceration upon the face; very common in India, and said to be caused by a vegetable parasite.

Delia. Festival of Apollo, celebrated at Delos.

Delibes, CLEMENT PHILIBERT LEO, 1836–1891. French musician; Prof. of Composition at the Paris Conservatory 1881; Member of the Institute 1884. Though also popular as a writer of operas (*Le Roi la dit*, 1873: *Jean de Nivelle*, 1880; *Lakme*, 1883), it was as a composer of ballets (*La Source*, 1866; *Coppelia*, 1870; *Sylvia*, 1876) that he won widest admiration.

Delicacy. That quality of a physical instrument in virtue of which it gives indications of wide range for small affecting causes. A thermometer with a large spherical bulb and a very small bore is delicate.

Delile, ALIRE RAFFENEAN, 1778–1850. Prof. Montpellier. *Histoire naturelle*, 1813; *Flore d'Égypte*, 1824.

Delille, JACQUES, 1738–1813. French poet, prof. in Paris; tr. Virgil's *Georgics*, 1769, and *Æneid*, 1804; *Paradise Lost*, 1805. *Imagination*, 1805.

Deliquescence. Property possessed by certain substances, *e.g.*, calcium chloride, of absorbing moisture from the atmosphere.

Deliquescent. Trunks of trees which exhibit very extensive systems of branching, caused by the vigorous development of nearly equally strong lateral buds, as in oaks, elms, etc.; opposed to Excurrent.

Delirium. Mental excitement with false impressions, delusions, illusions, etc., accompanying various diseases.

Delirium Tremens. Condition of mental excitement, hallucinations, sleeplessness, tremor, etc., due to the prolonged use of alcoholics or to the abrupt discontinuance in those habituated to the use of large amounts of them.

Delitzsch, FRANZ, D.D., Ph.D., 1813–1890. Theologian and expositor; prof. at Rostock 1846, Erlangen 1850, and Leipzig 1867. He pub. many commentaries, and tr. N. Test. into Hebrew 1877.—His son, FRIEDRICH, b. 1850, is prof. at Leipzig and a noted Assyriologist.

Delius, NICOLAUS, 1813–1888. German editor and expositor of Shakespeare; prof. at Bonn 1867.

Delivery. Transfer of possession from one to another.

Della Crusca. 1. Academy at Florence, founded 1582 to purify the Italian language and compile a dictionary. 2. School of English poetasters, beginning at Florence ab. 1785, and for a few years the fashion at home: satirized by Gifford in his *Baviad and Mæviad*, 1794–96, and soon extinct.

Della Valle, PIETRO, called THE PILGRIM, 1586–1652. He visited Egypt, Palestine, Mesopotamia, and India 1614–26. His travels were pub. in 4 vols., 1650–53.

Dellman, JOHANN FRIEDRICH GEORG, 1805–1870. Prof. Kreuznach; inventor of a special method of observing atmospheric electricity.

De Lolme, JEAN LOUIS, 1740–1806. Swiss refugee, living much in England. *Constitution de l'Angleterre*, 1771; *History of the Flagellants*, 1782.

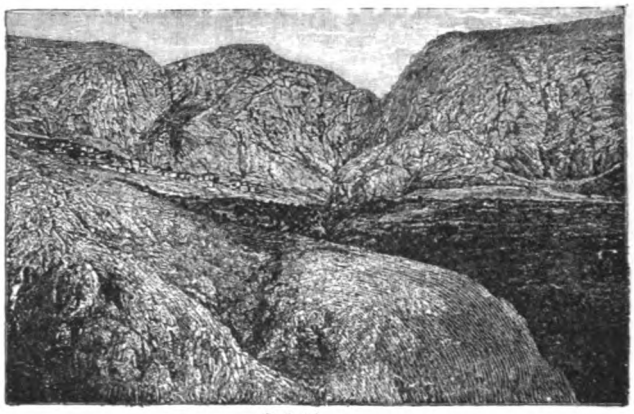
De Long, GEORGE WASHINGTON, U.S.N., 1844–1881. Arctic explorer, commanding the *Jeannette*, which sailed from San Francisco July 8, 1879, and sank June 13, 1881. He died in Siberia, near the mouth of the Lena.

Delorme, MARION, ab. 1612–1650. Mistress of Cinq-Mars and others; celebrated by V. Hugo and A. De Vigny. Tradition prolonged her life to 1706 or later.

Delorme, PHILIBERT, ab. 1500–1577. French architect.

Delos. Smallest of the Cyclades, a group of islands in the Ægæan; birthplace of Apollo and Diana; specially sacred to the former, who had a great temple here, and games in his honor every 4 years. Its commercial importance ended ab. 87 B.C.

Delphi. Town on Mt. Parnassus in Phocis, originally called Pytho; famous for its oracle of Apollo, the most renowned in Greece, and for the Pythian games celebrated every 4 years after 586 B.C. in a plain near by. The temple contained im-



Delphi.

mense treasures. The Sacred War was begun by the seizure of the temple 357 B.C. by the Phocians. Excavations by the French School at Athens are now in progress, the results so far are mainly confined to epigraphy and specification of sites and ground plans of buildings.

Delphin Classics. Edited by Bossuet, Huet, and other French scholars, for the Dauphin, son of Louis XIV., carefully expurgated, extended to 64 vols., 1674–1730.

Delphinia. Athenian festival of Apollo, held in April.

Delphinidæ (DOLPHINS). 1. A family of toothed whales (denticete *Cetacea*), having a conical, beak-like snout armed with pointed teeth. A dorsal fin is borne on the back and the caudal fin is transverse. The only other fins present are the pectorals. (A fish, *Coryphœna*, not a mammal, with brilliant colors, superficially shaped like the dolphin, but with no snout and with vertical caudal fin, is known by American sailors as the "Dolphin.") The true dolphin is especially numerous in the Mediterranean, following ships in flocks, averages 6 to 8 ft. in length, and has its blow-holes united on top of the head into one nasal aperture. See PORPOISE and GRAMPUS. Large and peculiar dolphins live in the Ganges and in the rivers of Bolivia.

Delphinus. The Dolphin. Northern constellation, consisting of four third-magnitude stars in the form of a lozenge, ab. 30° s. of Deneb in the Swan and 14° e. n. e. of the Eagle. It includes also several smaller stars.

Delpit, ALBERT, 1849–1893. French poet and novelist, b. in New Orleans. *The Invasion*, 1872.

Delsarte, FRANCOIS ALEXANDRE NICOLAS CHERI, 1811–1871. Founder of a psychologic and æsthetic system which has been applied mainly to gymnastics, and is used extensively in the U. S. and Europe in hygienic and artistic training.

Delta. Branches of a river at its mouth, with the islands between them, formed by deposit from the river, as the Nile, Mississippi, and Ganges.

Delta Metal. Alloy of zinc and copper to which has been added a small amount of spiegel-eisen. Used in ornamental work and in making rolls to crush powder, as it is not liable to give rise to sparks as steel does. Its properties are similar to phosphor-bronze. It is yellow; sp. gr. 8.4: mpt. 950° C. Its tensile strength is stated to be when cast 53,200 lbs., rolled 86,000.

Deltapurpurine. $C_{34}H_2N_6O_6S_2Na_2$. Sodium salt of the product of the action of diazoorthotolidine on the β-naphthylamine sulphonic acids; red powder, which dyes cotton red without a mordant.

Deluc, JEAN ANDRE, F.R.S., 1727–1817. Swiss naturalist, resident in England from 1773. *Hist. Earth and Man*, 1778.

Deluge. Traditions of a general or partial inundation, more or less similar to the Biblical account (Gen. vi.–viii.), are found among most races. The Chaldean story, ab. 660 B.C., was tr. by G. Smith 1872.

Delyannis, THEODORE, b. 1826. Prime Minister of Greece 1885–86 and 1890–92; rival of Tricoupis.

Demades, d. 318 B.C. Athenian demagogue and orator who opposed Demosthenes and supported the Macedonian party; executed by Antipater.

Demand. In economics, desire for commodities or services, accompanied by an offer of some equivalent for them.

Demand Price. Rate at which any particular amount of a commodity can find purchasers in a certain market at a particular time.

Demarest, DAVID, D.D., b. 1819. Prof. New Brunswick (N. J.) Theol. Sem. 1865. *Hist. Reformed Dutch Ch.*, 1856.

Dembinski, HENRY. 1791–1864. Commander-in-chief of Polish army 1830, and Hungarian 1848; in Egyptian service 1833–35. *Memoirs*, 1833.

Deme. Political subdivision of the phyte or tribe in Attica; corresponding to the modern borough or township.

Deme. Colony of Merides. When it is loosely integrated, each Meride is a zoöid, and the deme is a cormus, as in Hydroids; if thoroughly integrated, it becomes a prosopen, as in Mollusks, Arthropods, Vertebrates. Hæckel uses the term cormus in a restricted sense as referring to a colony of prosopens, in which case deme is used in the ordinary sense of cormus. See INDIVIDUALITY, BION, and CORMUS.

Demembré. In Heraldry the word signifies being cut into several pieces, but without having the severed fragments disarranged.

Dementia. Form of insanity in which the memory, will, and other mental powers are impaired; the brain is usually atrophied.

Demerit. Quality by which a moral agent renders himself worthy of punishment.

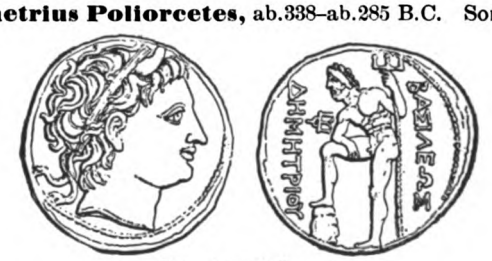
Demesne. Lands reserved by the lord of a manor for his own use.

Demeter. Greek goddess of the earth. See CERES.

Demetrius, d. ab. 1591. Son of Ivan IV. His name was assumed by a Pole who invaded Russia, defeated Boris, and reigned 1605–6, and by three more pretenders, who were executed 1610–13.

Demetrius Phalereus, ab. 345–283 B.C. Greek author and orator; under Cassander Gov. of Athens 317–307, where 360 statues were erected in his honor; later an adviser of Ptolemy Lagos and promoter of the Alexandrian library; finally exiled to Upper Egypt.

Demetrius Poliorcetes, ab. 338–ab. 285 B.C. Son of Antigonus. He took Athens 306, besieged Rhodes 305, was defeated at Ipsus 301, and was King of Macedonia 294–287.



Demetrius Poliorcetes.

Demetrius Soter, ab. 185–150 B.C. King of Syria 161.

Demi-Bastion. Earthwork designed to cover a bridge; generally two flank parapets whose crests are perpendicular to the bank of the stream, united by an inverted redan or swallow-tail, or by a bastioned front.

Demigod. Fabulous hero, one of whose parents was a god and the other a mortal; *e.g.*, Hercules, Castor, and Pollux.

Demi-Lion. In Heraldry, the upper half of the animal's body and half the tail with its terminating tuft.

De Mille, JAMES, 1837–1880. Canadian novelist; Prof. at Acadia 1860–65 and Dalhousie Coll., N. B., from 1865. *The Dodge Club*, 1866; *American Baron*, 1870.

Demi-Lune, or RAVELIN. Redan-shaped outwork, which in the bastioned system covers the curtain of the main work and places the adjacent bastion in a reëntering.

Demi-Parallels. Trenches constructed between the second and third parallels to give shelter to the supports, while the besiegers are advancing and before the third parallel is constructed.

Demiurge. In Gnostic speculations, creator of the earth; an inferior deity, variously imagined, but mainly evil.

Demmin. In Mecklenburg; scene of a defeat of Saxons by Slavonians 1164.

Democracy. Form of government in which the supreme authority is lodged in the people, who exercise it by members of their own order deputed for that purpose. The fundamental maxim of a democracy is that the people must choose their magistrates, whether the election is made by themselves directly, as at Athens, or by officers appointed for that purpose, as at Rome on certain occasions.

Democrat. Name now applied to one of the two principal parties in the U. S., originally a term of reproach. The party of which Jefferson was leader was first called Anti-Federalist, afterward Republican, and later Democratic-Republican. The distinctive principles of the Democratic party have been: 1, strict construction of the Constitution regarding the powers delegated to the Federal Government; 2, emphasis of local and State as against Federal sovereignty; 3, advocacy of low tariff duties; and 4, generally a regard for the rights and interests of the common man, regardless of nationality. In its early history, through its first leaders, the party reflected the political doctrines of liberty and natural rights prevailing in France prior to the Revolution, and sympathized with France in its struggles with England. Its dominance in the national government may be divided into two periods: that prior to the rise of the Whig party and covering the administrations of Jefferson, Madison, and Monroe; and those of Jackson, Van Buren, Tyler, and Polk, and extending to the rise of the Republican party. Subsequent to the Civil War the Democratic party was continuously defeated in the administrative department until 1884, when Grover Cleveland was elected President, and again in 1892, after the accession of the Republican party to power for a single term.

In 1884 there was a considerable accession to the Democratic party from the ranks of the Republicans, due in part to the high protection policy of the Republican party; but the elections of 1894 showed a significant reaction, due to hard times in trade and labor.

Democritus, ab. 469–ab. 357 B.C. Greek philosopher of Abdera in Thrace; founder of the Atomic doctrine. After travels in Asia and Egypt he lived in retirement, greatly respected, though called "the laugher." His writings survive in a few fragments only.

Demodex folliculorum. Species of *Arachnida* found in the sebaceous follicles; entirely innocuous.

Demodex folliculorum. Vermiform mite with four pairs of jointed stump-like feet, near the head. It has a suctorial proboscis, styliform jaws, and lives in the hair follicles and sebaceous glands of man and domestic animals; entirely innocuous.

Demogorgon. Deity of the unseen world, first named in 5th century. Spenser places him "in the bottom of the deep abysse"; Ariosto on the Himalaya Mts. See GORGONS.

Demoiselle. *Anthropoides virgo.* Graceful bird of the Crane family ab. 3 ft. 6 in. to top of head and 3 ft. from bill to tip of tail. The general tint is slate-gray with yellow bill. It

Demoiselle (*Anthropoides virgo*).

lives principally on grain and occasionally fish and insects. It is migratory, Africa being its headquarters, and great numbers are found at the Nile inundation.

De Moivre, ABRAHAM, F.R.S., 1667–1754. French-English mathematician who, with Lambert, introduced "imaginaries" into Trigonometry. *Annuities*, 1725; *Doctrine of Chances*, 1718–38; *Miscellanea Analytica*, 1730.

De Moivre's Theorem. Formula in trigonometric analysis, involving imaginaries.

$$(\cos x + \sqrt{-1} \sin x)^m = \cos mx + \sqrt{-1} \sin mx.$$

The fundamental formulas for sine and cosine of the sum of two angles in terms of functions of the angles separately can be derived directly from this theorem. It thus shows that "imaginaries" may have a logical place in leading to real results.

Demonetization. Removal of standard monetary value from any currency which has previously possessed it.

Demonology. Branch of religious belief which deals with the active agency of evil spirits. Forms of demoniacal possession are common to all Christian and Pagan creeds; and sorcerers, witches, and enchantresses are common to all literatures, sacred and profane. Belief in the Familiar Spirit is scarcely yet dead in Christendom. In England the statute of James I. enacting that all persons invoking an evil spirit, or consulting, covenanting with, entertaining, employing, feeding, or rewarding any evil spirit, should be guilty of felony and suffer death, was not repealed till the reign of George II. Spiritualism and Theosophy are fashionable modern variants.

Demonstration. Syllogistic process of proof; often synonymous with certitude.

De Morgan, AUGUSTUS, 1806–1871. Prof. Univ. Coll. London 1828–31 and 1835–67; author of mathematical text; books. *Doctrine of Probabilities*, 1838; *Formal Logic*, 1847-*Budget of Paradoxes*, 1872.

Demosthenes, d. 413 B.C. Athenian general, sent to Sicily to assist Nicias; defeated and executed by the Syracusans.

Demosthenes, 384–322 B.C. Greatest of Attic orators. He prepared for his profession with care, overcoming stammering and weak lungs by training. As a pure patriot he resisted the attempts of Philip of Macedon against the liberties of Greece in the orations known as Philippics 351–341. Bribery raised up a host of opponents, and his success varied. When the battle of Chæroneia 338 destroyed the hope of resistance, his enemies attacked him. His friends proposed giving him a golden crown as a token of his services, which Æschines opposed in his famous Oration on the Crown, but was beaten. After the death of Alexander the Great, D., who had been in exile, stirred up a rebellion, which was defeated in the battle of Cranon; pursued by Macedonians, he took poison.

Demosthenes.

Demotic Alphabet. Used in Egypt ab. 670 B.C.—A.D. 200; abridged form of the hieratic writing; found on the Rosetta Stone.

Dempster, THOMAS, ab. 1579–1625. Prof. at Paris, Pisa, and Bologna. *Hist. Eccl. Gentis Scotorum*, 1627.

Demulcents. Unirritating and slippery fluids, such as glycerin and watery preparations of gum arabic, flaxseed, slippery elm, Iceland moss, or sassafrass, which protect and lubricate inflamed surfaces; especially applicable in diseases of throat, lungs, and intestines.

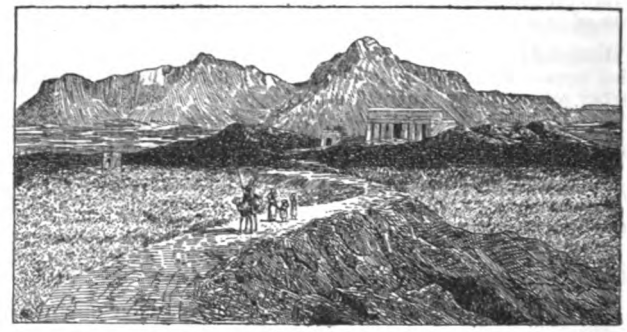
Demurrage. Delay of a ship in port beyond the stipulated period; or sum allowed for such delay.

Demurrer. Pleading admitting the facts alleged by the antagonist, but denying that they constitute a cause of action.

Denain. Town of n. France. Here Villars defeated the Allies under Prince Eugene, July 27, 1712. Pop., 1891, 16,663.

Denarius. Chief silver coin of Rome, originally worth 10 bronze asses, later reckoned at 16; debased by some of the later emperors, but restored by Diocletian and Constantine.

Denderah. Egyptian site of a temple finished under Cleopatra, whose portrait is carved on one of its walls; near the modern Keneh on the Nile.



Denderah.

Dendrerpeton. Bones of a small batrachian found by Lyell and Dawson in Nova Scotia, in the hollow of the trunk of an erect *Sigillaria*.

Dendrite. Name given to a mineral when it is marked with figures resembling growing tufts or moss, as in the Moss-agate.

Dendrocœla. Broad, flat turbellarian worms, generally marine, having a branched intestine, a muscular protrusible pharynx, and tentacles on the anterior end. They constitute the two groups *Monogonopora* and *Digonopora*.

Dendrochirotæ. See PEDATA.

Dendrodont Teeth. Consisting of many parts formed from separate papillæ, fused together so that enamel is infolded in complex manner.

Dendrogaia. Central America, West Indies, and tropical S. America.

Dendroid. In shape or outline like a tree.

Dendrolite. Petrified stems of trees and plants found in the secondary formation and especially in the coal strata. Sometimes found with fossil branches, fruit and leaves, but only as impressions. Many are hard and beautifully colored, so that they are cut and employed in the arts. When thin plates are examined under the microscope, the structure of the wood is so perfect as to enable botanists to tell the species of the plant to which it belongs.

Dendrology. Study of trees.

Dendrophidæ. See OPISTHOGLYPHA and TREE SNAKES.

Dendrostyles. Four connecting pieces that unite the syndendrium to the surface of the sub-umbrella in *Rhizostomidæ*.

Dengue. See BREAK-BONE FEVER.

Denham, DIXON, 1786–1828. English traveler who accompanied Clapperton to Timbuctoo 1821, to Lake Tchad 1823; visited Mandara and returned to England 1825; became Vice-gov. of Sierra Leone, where he died.

Denham, SIR JOHN, 1615–1668. English poet, knighted 1660. *The Sophy*, a tragedy, 1641; *Cooper's Hill*, 1643; *Psalms*, 1714.

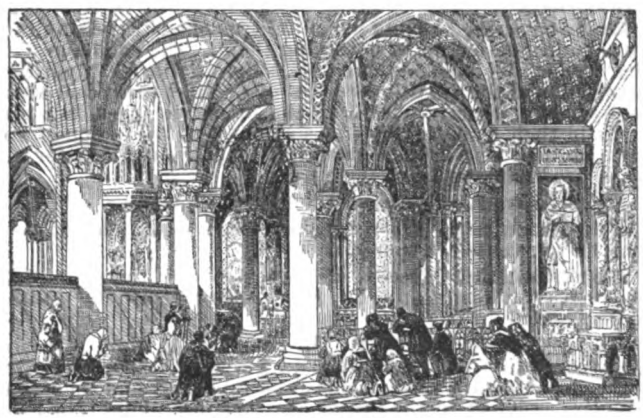
Denina, CARLO GIOVANNI MARIA, 1731–1813. Italian historian, long resident at Berlin and Paris. *Revolutions of Italy*, 1769–70; *Greece*, 1781–82; *Literary Prussia*, 1790–91; *Western Italy*, 6 v., 1809–10.

Denio, HIRAM, LL.D., 1799–1871. Circuit Judge of N. Y. 1834–38; Judge Ct. of Appeals 1853–66. *Reports of N. Y. Sup. Ct. and Ct. of Errors*, 1846–50.

Denis, JEAN FERDINAND, 1798–1890. French traveler, official, and author of books on S. America.

Denis, ST. Apostle of France and Bp. of Paris, martyred ab. 272; long supposed identical with Dionysius the Areopagite. His day is Oct. 9. The abbey named from him was founded ab. 630 by Dagobert I., who wished to be interred there. Falling into decay it was restored and solemnly inaugurated by Charlemagne 775. It suffered greatly during the Norman and other

invasions, and was rebuilt successively by Suger under Louis VIII., and Endes Clement and Matthew of Vendome. The choir was completed in 1281. The architecture is consequently



The Lady Chapel—St. Denis.

very varied, and most of the kings of France from Dagobert to Louis XVIII. lie here.

Denison, GEORGE ANTHONY, b. 1805. Archdeacon of Taunton 1851; prosecuted for heresy 1854; active in condemning Bp. Colenso and *Essays and Reviews*. *Notes of my Life*, 1878.—His brother, JOHN EVELYN, D.C.L., 1800–1873, was Speaker of the Commons 1858–72, suggested *The Speaker's Commentary*, and became Viscount Ossington 1872.

Denison University. At Granville, O.; incorporated 1832; called Granville College 1845–56. It has 15 instructors, an endowment of $375,000, and, with Shepardson College for Women, founded 1887, ab. 600 students.

Denizen. Natural-born subject, or alien made a subject by royal letters-patent in Britain, by statute in S. C.

Denman, HERBERT, b. 1855. American figure painter. S.A.A. 1887.

Denman, THOMAS. 1779–1854. M.P. 1818–26; Atty.-gen. 1830; Chief-justice of King's Bench 1832–50; Baron 1850.—His son, SIR GEORGE, b. 1819. M.P. 1859–72, became Judge and Knight 1872.

Denmark. Limited monarchy of w. Europe, occupying the peninsula of Jutland and adjacent islands; area 15,289 sq. miles. The surface is a plain. The coast is low and very broken. The industries are agriculture, fishing, and commerce. The capital is Copenhagen, the government a constitutional monarchy. The Cymri, who occupied Denmark 100 B.C., were followed by piratical Goths, of whom little is known till the mission of Anschar to S. Jutland 825. A long conflict between Paganism and Christianity ensued. The people were reduced to serfage by the introduction of a feudal system. Valdemar I. subdued Rugen and Pomerania, forcing them to accept Christianity 1168. The Baltic and its coasts were afterward almost wholly subjugated, but lost under Valdemar II., whose death 1241 was followed by 100 years of anarchy. Under Valdemar III. the lost territory was recovered. His daughter, Margaret, 1375–1412, by the Union of Calmar 1397 gained Sweden and Norway. Erik, her successor, after a 25 years' war with the Counts of Schleswig-Holstein, lost all three crowns. Christian of Oldenburg was chosen king 1448. He bought the title of Count-Duke of Schleswig-Holstein 1460, promising to keep these duchies united. Fifty years of international struggles ended in the separation of Sweden 1523. Under Frederic IV. the people rose against the nobles 1660. Christian VII. began to abolish serfage 1767. Under Frederic VI. the alliance with Napoleon brought Denmark to the verge of ruin, and at the Congress of Vienna 1814 she ceded Norway to Sweden. The direct Oldenburg line expired with Frederic VII. 1863, and Christian IX. succeeded, according to the Treaty of London 1852. A war with Prussia 1864 resulted in the cession of the duchies. Pop., 1890, 2,185,335.

Denmark, CAPITULATIONS OF. 1. 1480. England was allowed mercantile consuls in chief seaports, England engaging to pay Sound dues on all vessels passing through the strait.

2. 1629. At Lubeck; D. bound herself never to interfere in German affairs, and acknowledged Wallenstein as Duke of Mecklenburg.

3. 1660. Treaty of Copenhagen; D. ceded to Sweden Skaania, Aland, part of Rügen, and free passage through the Sound.

4. 1807. D. surrendered its entire naval force to England.

5. 1814. D. ceded Norway to Sweden, which gave up Pomerania to D.; England restored her conquests from D. in E. and W. Indies.

6. 1864. By Peace of Vienna, D. renounced all claim to Lauenburg, Holstein, and Schleswig.

Denmark, CHURCH OF. Lutheran; governed by bishops (of interrupted succession), the Metropolitan being the Bp. of Zealand.

Denner, BALTHASAR, 1685–1747. German painter, realist of overminute and literal tendencies, especially devoted to portraits of old people. His best known works are two in Dresden; others are in Munich, Vienna, and the Louvre.

Dennery, ADOLPHE PHILIPPE, b. 1811. French playwright.

Dennewitz. Village of Prussia, 42 m. s.w. from Berlin. The French under Ney were defeated here by the Prussians and Allies under Bülow, Sept. 6, 1813.

Dennie, JOSEPH, 1768–1812. American essayist; ed. *Portfolio* from 1801.

Dennis, JOHN, 1657–1734. English dramatist, critic, and pamphleteer, noted for his "rancorous pen."

Dennison, WILLIAM, 1815–1882. Gov. of Ohio 1861–62; U.S. Postmaster-gen. 1864–66.

Denominator. Element of a fraction which is below the fractional line. In arithmetic it gives the value of the fractional unit; in algebra it is the divisor when the division is expressed in the fractional form.

Denon, DOMINIQUE VIVANT, BARON, 1747–1825. French art critic; Academician 1787. *Travels in Egypt*, 1802.

Dens, PETER, 1690–1775. Pres. R.C. College of Malines, Belgium, from 1735. His *Moral and Dogmatic Theology* is still widely used.

Densimeter. Hydrometer of variable immersion,

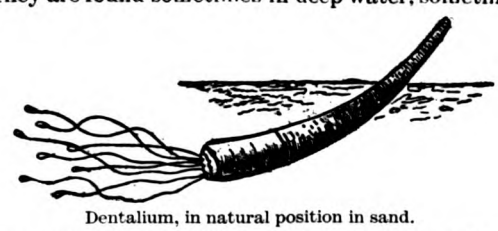
Density. Quantity of matter contained in a unit of volume, or $D = \frac{M}{V}$, where D, M, and V, denote respectively the density, mass, and volume of a body. The sp. gr. of a substance is the ratio of the weight of any volume of it to the weight of an equal volume of water at a temperature of 4° C. As the gram or unit of mass is the mass of one cubic centimeter of water at 4° C., the density of a substance in grams per cubic centimeter is numerically equal to its sp. gr. There are three general methods of determining specific gravities; viz., by means of the HYDROSTATIC BALANCE, the SPECIFIC GRAVITY BOTTLE, and the HYDROMETER (q.v.). See also MOHR'S SPECIFIC GRAVITY BALANCE. JOLLY'S BALANCE. HARE'S APPARATUS, SPECIFIC GRAVITY BULBS, and STEREOMETER.

Density of the Earth. Determined by comparing the attractive force of the earth with that of some known mass of matter, as a mountain, the method of Maskelyne; or two large balls of lead, the method of Cavendish. To obtain a result of any value, great care is necessary. By the above and other methods a mean density of about 5.6 times that of water is obtained.

Dental Formula. One which exhibits the number and kinds of teeth possessed by an animal. The kind is indicated by the initial, the number by figures of a fraction whose numerator designates the teeth of the upper and the denominator those of the lower jaw. In Man, I = Incisors, C = Canines, P = Premolars, M = Molars.

$$\text{I}\ \frac{2-2}{2-2}\ \text{C}\ \frac{1-1}{1-1}\ \text{P}\ \frac{2-2}{2-2}\ \text{M}\ \frac{3-3}{3-3} = 32$$

Dentalium. Genus of mollusks of very wide geographical distribution, most seas having some of the species of various size. They are found sometimes in deep water, sometimes near



Dentalium, in natural position in sand.

the shore. About 40 recent species have been described and 70 fossil. The animal is conical and elongated, with a shelly investing tube like an elephant's tusk. The Pacific Coast Indians use the shells for ornaments and currency.

Dentary. Splint bone on the lower jaw of Vertebrates, bearing the teeth.

Dentation. Systems of incision or toothing of the margins of leaves, especially such as do not extend deeply into the blade.

Dentatus, MARCUS ANNIUS CURIUS, d. 265 B.C. Roman plebeian, thrice consul, censor 272. He defeated the Samnites 290, and Pyrrhus 275 B.C.

Denticete. See ODONTOCETI.

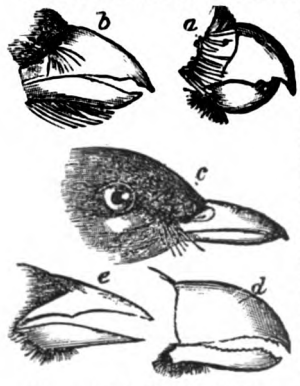
Dentifrice. Powder for the teeth; variously composed; chalk, magnesium carbonate or infusorial silica, perfumed with an essential oil or with orris root, is good.

Dentil. In Classic Architecture, the square block applied at equal intervals to the face of a horizontal member, which is then said to be dentilled, resembling teeth.

Dentine. Brittle, bone-like substance forming the inner and greater part of teeth.

Dentirostral. Having notched bill, as in Wrens.

Dentirostres. Tribe of Passerine Birds having a variously shaped beak with a notch in the upper mandible near the point. There are ten primary remiges, of which the first may be rudimentary. Most are Oscines. Examples are: *Corvidæ* (Crows, Daws, and Magpies), also Birds of Paradise; in these the two middle rectrices are long, filiform, with a small vane at the end, and the male has also tufts of lax feathers on neck, breast and sides. Here also belong the Starlings, Shrikes, Fly-catchers, Titmice, Wagtails (*Motacilidæ*), *Sylviidæ* (Warblers, Wrens), and Thrushes (*Turdidæ*), to which family belong also the Nightingale, European Blackbird, and American Robin. Of the Starling family (*Sturnidæ*) are the Bower-birds of Australia.



Examples of Notched Bills.

The notches or serratures are evidently adapted to the better securing of the prey; and this conformation appears not only in the *Dentirostres*, but in birds of other groups and orders. Examples may be seen in the double-toothed Falcons, as in the genus Harpagus, *a*; in the Nogons, *b*; in the sub-genus Andropadus, *c*; and in the Chizærhis Variegata, *d*, where the teeth are small, sharp, regular, and of equal size. The *Lanio* of Vieillot, *e*, has a central or raptorial tooth to its bill.

Dentistry. Everything which relates to care, preservation, etc., of teeth. Dentists are mentioned by Galen, Hippocrates, and several writers before the Christian era, and they are believed to have existed in prehistoric times in Egypt. Until first years of nineteenth century, teeth were attended to by medical men, who paid little attention to preservative methods. Until within comparatively recent times the vast majority of dentists were poorly educated, but now they compare favorably with medical men of equal opportunities, and to them are often committed the treatment of fractures and many diseases of the jaws. False teeth are prehistoric and were formerly made of bone or ivory and held in place by wires or cords. Later human teeth were employed, but abandoned in favor of those made of refractory porcelain. Gold, silver, and platinum are sometimes used for plates into which teeth are set, but vulcanized rubber is employed more generally, being lighter and cheaper. Gold, amalgam of tin and silver, tin, silver, oxychloride and phosphate of zinc and guttapercha are the agents used for filling or plugging teeth. Choice of one to be employed depends upon condition of tooth, but gold is the most generally useful. Teeth of valuable horses and cows are often filled, with good results. See CORNETO.

Dentition. Act or process of teething; arrangement of teeth in the jaws. Cutting of temporary teeth is primary dentition, that of permanent teeth secondary.

Dentition. Set of teeth possessed by a vertebrated animal. Among the lowest fishes (Sharks) there are indefinite numbers of rows of teeth, but higher in the scale of vertebrate life there becomes established, as in Mammals, a milk dentition of deciduous teeth, and a permanent set. Among the Edentates and whalebone whales the second set has been suppressed. The teeth of higher animals become differentiated into incisors, canines and molars; and the molars again take on a great variety of forms. See PROTODONT, PTYCHODONT, HAPLODONT, BUNODONT, LOPHODONT, ANTIODONT, AMŒBODONT, SELENODONT, TRICHECHODONT, LOXOLOPHODONT, and DENTAL FORMULA.

Denudation. Exposure of rocks by the removal of the overlying strata through the action of the weather. The word is often used as a synonym for erosion.

Denver. Capital and principal city of Colorado, in Arapahoe co., on the South Platte, 15 m. below its exit from the mountains, at an elevation of 5,200 ft. It is regularly laid out, with over 200 miles of streets. Water is supplied by the Holly System from the South Platte and by artesian wells. It is the main distributing point for the mines in the mountains, and an important railroad center. Pop., 1890, 106,713, having trebled since 1880.

Denver, JAMES W., 1817–1892. M.C. from Cal. 1855–57; Gov. of Kan. 1857–58; Gen. U. S. Vols. 1861–63.

Deodand. Chattel which caused human death and was forfeited to pious uses for the benefit of deceased's soul. Obsolete.

Deodatus, or DEUSDEDIT. Pope 615–618; canonized. His day is Nov. 8.

Deodorants. Agents which destroy offensive odors either by chemical action or by absorbing them. The commonest of the former are chlorine, bromine, sulphur dioxide, hydrogen peroxide, and the volatile essential oils. Dry earth and charcoal act by directly absorbing the offensive gases, but also assist in their oxidation by exposing them to the action of the air. Pure deodorants are not disinfectants, but the latter are often deodorants as well.

Deontology. Ethics, or the science of duty.

Deoperculate. Sporanges of mosses which do not open by a lid to release the spores.

Deoxidation. Process of reducing from the state of an oxide, by withdrawing the oxygen. Accomplished by heating with charcoal, or in a hydrogen flame.

Department, MILITARY. In the U. S., in time of peace, army corps, divisions, and brigades are not formed; instead of these, departments or divisions are established, and their commanders assigned by the President. Those are, that of the East, with headquarters at Governor's Island, N.Y.; of Missouri, at Chicago; of Dakota, at St. Paul; of the Colorado, at Denver; of the Platte, at Omaha; of Texas, at San Antonio; of the Columbia, at Vancou ver Barracks; and of California, at San Francisco. The Military Academy, the Artillery School, the Engineers' School, the general recruiting depôts, the arsenals, the general depots of supply, such permanent fortifications as may be in process of construction or repair, and officers employed on special duties under the Sec. of War, are exempted from the supervision of division and department commanders, except in special cases of emergency.

Departure. In meteorology, amount by which any given observed quantity is greater or less than the average observed value of that quantity, without assuming or introducing any theory as to what constitutes an ideal normal value.

Departures and Latitudes. In surveying, the distance of one end of a line north or south of the other end is called its latitude; the distance of one end east or west of another is its departure. These quantities are used in computing the areas of fields.

De Pauw University. At Greencastle, Ind.; Methodist. Chartered as Indiana Asbury Univ. 1837; name changed 1884 in honor of W. C. De Pauw, who gave it ab. $1,000,000. It has (1895) 23 professors, with 14 instructors, 399 students in arts, and 54 in theology.

Depew, CHAUNCEY MITCHELL, LL.D., b. 1834. Vice-pres. N.Y. Central R. R. Co. 1882; pres. 1885; eminent as an orator.

De Peyster, JOHN WATTS. b. 1821. Major-Gen. N.Y. militia 1866; historical writer. *Caurausius*, 1858.

Depilatory. Agent for removing hair. Caustic lime and arsenic are chemical substances most commonly employed, but produce no permanent results, as they simply destroy portion of hair external to skin. Introduction of needle, heated by electric current, into hair follicle is most effectual, the life of hair being destroyed.

Depolarization. If a thin plate of any doubly-refracting substance be interposed between two crossed Nicol prisms or between the analyzer and polarizer of a polariscope so arranged that no light emerges from the former, the capability of the analyzer to transmit the beam is suddenly restored, and the light is said (though incorrectly) to be depolarized by the interposed plate.

Depolarizer. Thin plate of mica or selenite placed between two crossed Nicol prisms.—ELECTRICITY. Some chemical agent, as HNO_3, or $CuSO_4$, capable of combining with H; thus preventing the gas from collecting on the electro-negative element of a galvanic cell.

Deposit. 1. Property bailed to another to be returned in kind. 2. Money left with a banker, who becomes debtor for the amount.

Deposition. Written evidence verified by oath; or given under formal interrogatories in a legal proceeding.

Depot. Railway passenger or freight station: not customary in technical literature, the word station being preferable. In a large station the roofed part, where trains stop, is generally called a train-shed; the largest in the U. S. is that of the Pa. R.R. at Phila., which is 307 feet wide and 647 feet long.—Location for the collection and distribution of military stores and material.

Depping, GEORG BERNARD, 1784–1853. German-French historian of the Normans and Normandy, 1826–35, and of the Jews in the Middle Ages, 1834.

Depreciation. In Economics, decrease of value of any one form of currency relatively to another; also, decrease in the price of gold or silver bullion.

Depres, or **Desprès,** JOSQUIN, ab. 1440–1521. Flemish composer and singer, active in Italy and France.

Depressed Arch. In Architecture, one in which the triangle formed by lines drawn from side to side at the impost and from the extremities of this to the apex is less than equilateral.

Deprez, MARCEL, b. 1843. French electrician.

De Profundis. Psalm 130 (in the Vulgate 129), said or sung at burials.

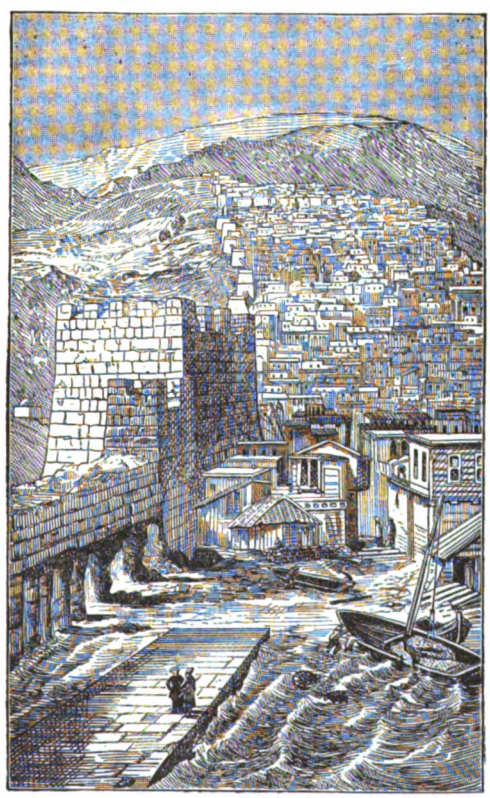
Deptford. Town of England, on the Thames, at the mouth of the Ravensbourne, 4 m. below London Bridge. It contains the storehouses for the supply of quartermaster and commissary stores to the British navy, and till 1869 had a dockyard, where Queen Elizabeth knighted Drake, and Peter I. of Russia learned shipbuilding 1698. Pop., 1889, 105,000.

Deputy. One exercising authority delegated to him by another, as a sheriff; in France and Italy, member of the Lower House or Chamber of Deputies.

De Quincey, THOMAS. 1785–1859. English essayist. *Confessions of an Opium-Eater*, 1821; *Klosterheim*, 1839; *Logic of Political Economy*, 1844. His works, almost wholly contributions to periodicals, were gathered in 18 vols., 1851–58. His splendid talents were obscured by the habits of an eccentric recluse.

Derailment. Railroad accident caused by the train leaving the track through some other cause than collision with another train. In 1893 there were 2,307 train accidents in the U. S., of which 1,212 were due to derailments, 996 to collisions, and 99 to other causes. In these 691 persons were killed—262 in derailments, 381 in collisions, and 48 in other accidents. In round numbers, one person is killed in a train accident for each million miles traveled by a train. Derailments are caused by defects of roadbed, defects of rolling-stock, negligence in operation, and obstructions on the track; the numbers due to these in 1893 were 214, 241, 137, and 197 respectively.

Derbend. Port on w. shore of Caspian Sea, once of commercial and strategic importance; taken by Arabs 728, by



Derbend.

Mongols 1220, and by Russians 1813; now capital of Daghestan. Pop. ab. 15,000.

Derbesieæ. Family of green Algæ of the order *Siphonaceæ*, including the single marine genus *Derbesia*.

Derby. Ancient borough of Derbyshire, on the Derwent, 92 m. s. e. of Liverpool; celebrated for its manufactures of porcelain and silk. Its school was founded 1162. Pop., 1891, 94,146.

Derby Day. First Wednesday of the summer races at Epsom, Eng., at the end of May, run for the Derby stakes, the most important race in the country, originated by the Earl of Derby 1780. The entries are made two years before the race, for yearlings only, the first prize being £5,000, with the surplus of entrance fees, and second and third prizes. The course is 1½ m. long and has been run in 2m. 43s.

Derby, EDWARD GEOFFREY SMITH-STANLEY, 14TH EARL OF, 1799–1869. M.P. 1820, Sec. for the Colonies 1833–34 and 1841–45, Baron 1844, Earl 1851, Premier 1852, 1858–59 and 1866–68. He tr. the *Iliad* 1865.—His son and successor, EDWARD HENRY SMITH-STANLEY, D.C.L., LL.D., F.R.S., 1826–93, M.P. 1848, was Foreign Sec. 1858–59, 1866–68, 1874–78, and 1882–85.—His brother, FREDERICK ARTHUR STANLEY, 16th Earl, b. 1841, M.P. 1862, has been in several cabinets, and was Gov.-gen. of Canada 1888–93. This family has held the earldom since 1485.

Derby, GEORGE HORATIO, U. S. A. ("JOHN PHŒNIX"), 1823–1861. Humorist. *Phœnixiana*, 1855.

Derby, ORVILLE ADALBERT, b. 1851. American geologist, in Brazil since 1885.

Derbyshire Neck. Goître.

Derbyshire Spar. Local name for fluorite.

Dercyllidas. Spartan general in Asia Minor 399-396 B.C.

Derecho. Strong local winds blowing in a rectilinear path over a small region of country, with sufficient force to cause some destruction.

Derelict. Abandoned chattels, especially those found at sea. A vessel in this condition may be brought in by the finders, who can claim salvage; if worthless, it may be destroyed as dangerous to mariners.

Derivation. Generalized method for developing functions into series; founded upon the calculus of operations devised by Arbogast.

Derivatives, SUCCESSIVE. Functions derived from the primitive by successive differentiation, obtaining successive differential coefficients. If the primitive function be designated by $\int.(x).$, the derivations will be $\int'(x).: \int''(x): \int'''(x)$ etc.

Derived Demand. Indirect demand for raw materials or for services, arising from a direct demand for commodities into which these enter.

Derm, or DERMA. Skin of an animal.

Dermatitis. Inflammation of the skin.

Dermis. See DERM.

Derived Polynomials. Successive functions in lower degree of one variable obtained from a given primitive by differentiation.

Dermatobranchia. See NUDIBRANCHIATA.

Dermatogen. Outer layer of cells in a very young stem; those from which the epidermis is developed.

Dermatology. Study of the skin and its diseases.

Dermatophyte. Plant growing parasitically on the skin of animals, as certain minute Fungi.

Dermatoptera. See FORFICULIDÆ.

Dermogastric Pores. Those of Sponges. See INCURRENT PORES.

Dermoptera. See GALEOPITHECIDÆ.

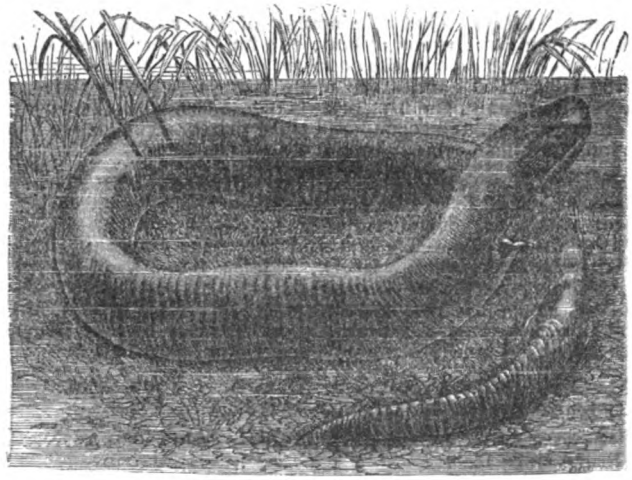
Dermosclerites. Spicules in the cœnosarc of Sea-fans.

Dermoskeleton. 1. Hardened and ossified dermis or corium, which forms the greater part of exoskeletal structures; *e.g.*, scales of fishes, hard part of the turtle's shell, plates on the back of the crocodile, and rings of the armadillo. 2. Shell of crabs.

Dermotea. See GALEOPITHECIDÆ.

Derotrema. Tribe of *Ichthyoidea* (Urodele Amphibians), including forms having no gill tufts in the adult, though a branchial aperture on each side of the neck may remain. They have tooth-bearing maxillary bones. Here belong the eel-like *Amphiuma* of Florida, with two pairs of two-toed limbs, and the plump *Menopoma*, with four anterior and five posterior toes. Some of these are among the largest of existing Amphibia,

though fossil forms are much more gigantic. The Hell-bender, water-dog or "alligator" of Ohio, etc., may attain a length of two feet. The gills disappearing in the adult stage, the group



Derotrema (*Amphiuma means*).

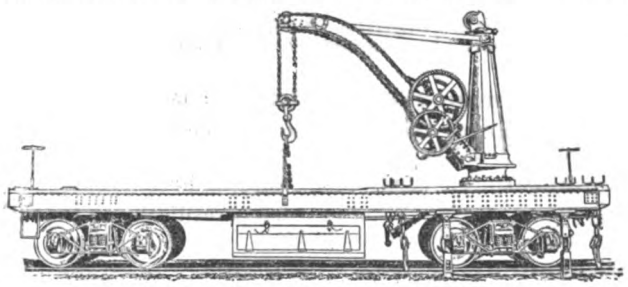
has been termed *Caducibranchiata*, which includes also the Salamanders.

Déroulède, PAUL, b. 1848. French poet; deputy 1889, supporter of Boulanger. *L'Hetman*, a play, 1877; *National Education*, 1882.

Derqui, SANTIAGO, ab. 1810–1861. Pres. Argentina 1860.

Derrick. 1. Floating crane with a central mast, standing upon a scowlike hull, to which it is strongly braced; the jib extends horizontally at a considerable elevation, and equally on both sides of the mast. A counterbalance can be run out and in on the jib on one side to equalize the weight on the other side. It is used for putting boilers and machinery into vessels. 2. Hoisting machine for lifting weights, but without a buggy, for easy horizontal motion of the load. A winding barrel and gearing is at one end of a frame, and a pulley-block or purchase is hooked to the other end. The frame, being stood up in an inclined position and stayed with guy-ropes, is much used by builders to lay heavy stones. A hauling derrick is a simple windlass frame. The quarry derrick has a mast and inclined boom; the boom can swing around the mast, but radial motion is given only by raising or lowering the end of the boom. In oil-well practice, the derrick carries the pulleys and apparatus for drilling the well. See CRANE.

Derrick Car. Railroad car upon which is mounted a derrick for use in construction, or for clearing the track in case of



15-ton Derrick Car, Pennsylvania Railroad.

wrecks. The design shown is for the single derrick. Others have two cranes mounted on the same frame; one over each truck.

Dervishes. Sect of Mohammedan devotees, not bound by vows, but often celibate. They are fanatical in their worship, and disposed to make light of all religious authority except their own, but exert immense influence. The best known of their numerous orders are the Dancers or Whirlers, and the Howlers. They love to work themselves into ecstatic states, singing chants loudly, or spinning around violently, hence the names "howling" and "dancing dervishes."

Derwentwater. Lake in Cumberland, 3 m. by 1, expansion of the Derwent; noted for its beauty; celebrated by Wordsworth.

Derwentwater, JAMES RADCLYFFE, EARL OF, 1689–1716. English Jacobite, engaged in the rebellion of 1715, and executed.

Derzhavin, GABRIEL ROMANOVITCH, 1743–1816. Russian lyric poet and high official. His *Ode to the Deity* is noted for its sublimity, and has been tr. from England to China.

Desaix de Veygoux, LOUIS CHARLES ANTOINE, 1768–1800. French general, who covered Moreau's retreat in Germany 1796, conquered Upper Egypt 1799, and saved the day at Marengo, but fell in the action.

De Sanctis, FRANCESCO, 1818–1883. Italian patriot, imprisoned 1850–53; prof. at Naples 1862, ed. *L'Italia*. *History of Italian Literature*, 1870.

De Sanctis, LUIGI, 1808–1869. Italian Protestant; prof. at Florence 1864.

Desargnes, GERARD, 1593–1662. French mathematician, who made important suggestions in Analysis and "Projective Geometry." *Perspective*, 1636; *Conics*, 1639; *Works*, 2 v., 1864.

Desaugiers, MARC, 1772–1827. French lyric poet, ranking next to Béranger for light verse.

Desbarres, JOSEPH FREDERICK WALLER, 1722–1824. Anglo-Canadian engineer, cartographer, and official; Colonel 1798. He surveyed the Nova Scotia coast 1763–77. *Atlantic Neptune*, 4 vols., 1777.

Descartes, RENE, 1596–1650. French thinker and mathematician, founder of modern philosophy. He based the reform of scholasticism on an appeal to consciousness instead of authority. *Discourse on Method*, 1637; *Meditations*, 1641; *Principia Philos.*, 1644. Cartesianism, the philosophy which was maintained by the school of Descartes, and which is represented by dualism with internal tendencies toward both idealism and pantheism, though in its founder they were counteracted by an irreconcilable opposition between mind and matter. He devised the method of "Indeterminate Coefficients," also the law of signs for the roots of an equation. His name is attached to a class of curves, "Cartesian Ovals," and to the system of co-ordinates in general use. He founded Analytical Geometry by a work pub. 1638, and again 1659, with commentaries by Van Schooten. His works, edited by Victor Cousin, were collected in 11 vols., 1824–26.

Descension Theory. Theory of the formation of ore-deposits, holding that the movement of the ore was from above downward.

Descent. Succession to an intestate's realty; determined in the U. S. by statutes.

Descent of Man. See DARWINISM and EVOLUTION.

Deschamps, EMILE, 1791–1871. French dramatist, lyric poet, and critic.

Deschamps, EUSTACHE, 1328–ab.1410. French poet, author of *Mirror of Marriage*, *Art of Verse*, and many lyrics.

Deschanel, EMILE AUGUSTE ETIENNE MARTIN, b. 1819. Prof. Coll. de France 1881. *Aristophanes*. 1867; *Racine*, 1884.

Descloizeaux, ALFRED LOUIS OLIVIER, b. 1817. French mineralogist, Prof. at the Sorbonne. His investigations of the crystallographic and optical properties of minerals have been many and important.

Descloizite. $Pb_2V_2O_7$. Rare mineral, containing lead, zinc, and vanadium.

D'Esclot, BERNAT, 13th century. Catalan historian.

Deseret, UNIVERSITY OF. At Salt Lake City, Utah, opened 1850, and again as a commercial school 1867. Classical, scientific, normal, and preparatory departments were added 1869–70.

Desert. Strictly, land without soil or vegetation. Most so called deserts have soil and sparse vegetation, such as *Artemisias* and *Cactaceæ*.

Desertion. Unlawful abandonment of a legal relation.

Desfontaines, RENE LOUICHE, 1750–1833. Prof. Botanical Garden in Paris. *Flora Atlantica*, 1798–1800; *Trees and Shrubs of France*, 1809.

Deshayes, GERARD PAUL, 1795–1875. French conchologist and geologist, who assisted Sir Charles Lyell in his division of Tertiary Strata. *Description des coquilles fossiles des environs de Paris*, 3 vols., 1824–37; *Traité élémentaire de conchyliologie*, 2 vols., 1839; *Description des animaux sans vertebres decouverts dans le bassin de Paris*, 1856–65.

Design. In architecture the mental conception of a proposed erection; commonly used to denote the drawing or drawings in which this conception is noted.

Design. Purpose, involving the idea of final causes, which represent that adjustment of means to ends which suggests intelligence as the agent producing a rational order of events.

Desire. Active mental phenomenon based on an appar-

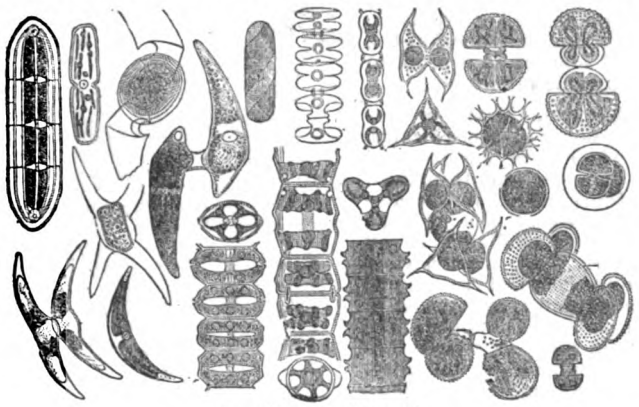
ently original instinctive impulse to seek what is pleasurable and to avoid what is painful or disagreeable. This impulse which is at first vague and indefinite, becomes desire only when it is clearly and definitely conscious. Desire then becomes one of the chief incentives to voluntary action.

Desma. Form of sponge spicule present in the genus *Vetulina*, shaped like a star, but with rays irregular in length, arrangement, and shape.

Desmacytes. Fusiform connective tissue cells, united into bundles of fibers that serve to hold spicules (especially desmas) together in the cortex of sponges.

Desman. See SORICIDÆ.

Desmids (DESMIDIACEÆ). Order of unicellular green Algæ, resembling the diatoms in many respects, but differing from



Desmids (*Desmidiaceæ*).

them in the absence of silica in the cell-walls. Extremely abundant in stagnant water.

Desmobacteria. Bacteria united into long-jointed filaments, as *Leptothrix*, actively growing *Bacillus*, etc.

Desmognathous. Birds whose maxillary bones have their maxillo-palatine processes uniting to form the roof of the mouth. The voiner is truncate in front, or small and obselete. Examples are: Birds of Prey, Parrots, Cuckoos, Kingfishes, Trogons, Anserines, Storks, and Cormorants. The natatorial section thus characterized includes the groups *Steganopodes* and *Lamellirostres*.

Des Moines. City of Polk co., Iowa, capital of the State since 1857; on Des Moines R., at the mouth of Raccoon R.; founded 1852. It is irregularly laid out, has 200 miles of streets, and is supplied with water by pumping from Raccoon R. Pop., 1890, 50,093.

Des Moines River. Righthand branch of the Miss., heading in s.w. Minn., flowing s. e., and joining the Miss. at Keokuk. Length 402 miles, drainage area 14,652 sq. m., mean flow 8,225 cubic ft. per second.

Desmomyaria. See SALPS.

Desmond, GARRET FITZGERALD, EARL OF. d. 1583. Chieftain of s.w. Ireland, thrice in revolt against Queen Elizabeth.

Desmothoraca. Order of *Heliozoa*, in which there is an enveloping shell of silica, pierced by numerous holes; *e.g.*, *Clathrulina*. This Heliozoan resembles the marine *Radiolaria* so strongly as to have suggested the name "Fresh-water *Radiolaria*" for these animals; but they are destitute of a central capsule.

Desmoulins, CAMILLE, 1760–1794. French revolutionist; brilliant journalist and pamphleteer. He was concerned in the destruction of the Bastile, voted for the death of the king, and was a friend and admirer of Danton, with whom he was arrested March 30, 1794, and guillotined April 5.

Desor, EDWARD, 1811–1882. Swiss geologist and naturalist, whose chief works related to the glaciers of the Alps. He accompanied Agassiz to the U. S. 1887, and made with Rogers a geological survey of the mineral region of Lake Superior.

Desor, TYPE OF. Development of Nemertines without a pilidium stage.

De Soto, FERNANDO, 1496–1542. Spanish officer with Pizarro in Peru; appointed governor of Cuba and Florida 1537. He wandered with his companions four years through Florida and as far as the Mississippi River, which he is said to have discovered; died as the expedition was returning, and was buried in the Mississippi.

Despard, EDWARD MARCUS, 1751–1803. Irish conspirator; colonel in British army under Nelson; dismissed from a government position, he planned to kill the king and set up a republic; arrested Nov. 16, 1802, and with six others hanged Feb. 21, 1803.

Des Périers, BONAVENTURE, ab. 1500–1544. French author, who lived at the court of Navarre and probably wrote much of the Heptameron. His *Cymbalum Mundi*, 1537, raised a storm by its heresies; his *Joyeux Devis*, 1558, contains 129 graceful tales.

Desquamation. Falling off of the skin in scales, as in scarlet fever.

Dessalines, JEAN JACQUES, 1758–1806. Haitian slave; leader in insurrection 1791; general under Toussaint; Gov. 1804, "Emperor" 1805.

Dessau. Capital of Anhalt in central Germany. Here Wallenstein defeated Mansfeld, April 25, 1626. Pop., 1890, 34,674.

Destouches, PHILIPPE, 1680–1754. French comic dramatist. *Le Philosophe Marié*, 1727; *Le Glorieux*, 1732.

Desvaux, AUGUSTIN NICAISE, 1784–1856. Prof. Angers. *Journal de Botanique appliquée*, 1813–14; *Flore de l'Anjou*, 1827; *Botanique*, 1838–39.

Detail. In Architecture, the smaller subdivisions of a design, such as moldings. An aggregation of details, such as is presented by a column, arch, window, doorway, chimney-piece, etc., is commonly called a feature.

Detaille, JEAN BAPTISTE EDOUARD, b. 1848. French mili-

The Reconnaissance, by Jean Detaille.

tary painter. One of his best works, a scene from the Franco-Prussian war, is in the N. Y. Metropolitan Museum.

Determinants. Branch of algebraic analysis, of great value in higher algebra and co-ordinate geometry. A determinant is an algebraic sum of products of n^2 elements, taken "n" at a time. These elements are arranged in n rows of "n" columns each, and are so combined that no product contains two elements from the same row or the same column. The algebraic sign of the products (+ or —) depends on the number of reversions of factor elements from their normal order.

Determinate Equation. One having a limited number of roots.

Determinate Inflorescence. See CYMOSE.

Determinism. Denial of the freedom of the human will in action. See VOLITION.

Detinue. Common law action for recovery of specific chattels with damages.

Detonating Meteors. Meteoric bodies whose appearance is accompanied by a noise like an explosion, but of which fragments are not known to reach the earth. Also called Bolides.

Detonation. Instantaneous resolution of an explosive into other forms of matter, many volumes of gases, usually by means of fulminating compounds, or of other masses by their intervention. It is distinguished from other explosions by the rapidity with which the solid or liquid explosive is converted into gaseous products. The fulminates of mercury, silver, etc., are usually employed in detonating fuses. The explosion of detonating compounds is attributed to a vibratory movement, which may operate independently of heat and the impact of gases produced by the explosion of the priming. The rapidity of detonation or explosive wave of gun-cotton is 6,000 in. per sec., and of dynamite is 5,000 metres per sec., whereas the ordinary combustion of these if lighted is comparatively slow. See EXPLOSIVES.

Detouche, LAURENT DIDIER, 1815–1882. French historical and genre painter.

Detritus. Material worn from solid beds by erosion.

De Trobriand, PHILIP REGIS, b. 1816. French baron, who came to N.Y. 1841, ed. *Courrier des États-Units*, 1854–61, served through the Civil War, and was Colonel U.S.A. 1866–79. *Campagnes à l'armée du Potomac*, 1867.

Detroit. City of Wayne co., Mich., on Detroit R., between Lakes St. Clair and Erie. It is regularly laid out, and supplied with water by pumping from the river. It is a center for 8 railroads, and has a very extensive commerce and large manufactures. Much of the iron and copper mined on the Upper Peninsula is smelted here. The site was visited by the French 1610, and settled by them 1701 as Fort Ponchartrain. It passed to the control of the British 1763, to that of the U. S. 1796, was given up to the British in 1813, but recovered 1814; chartered as a city 1824; State capital 1837–47. Pop., 1890, 205,876.

Detroit River. Connecting Lakes St. Clair and Erie; ab. 23 m. long.

Dettingen. Village of Bavaria where George II. of England, in command of British and German forces, defeated the French under Noailles, June 27, 1743.

Deucalion. In Greek tradition, survivor, with his wife Pyrrha, of the flood. They repeopled the earth by casting behind them stones, which turned into men and women.

Deuteronomy. Fifth book of Moses, containing a repetition, with many variations, of the Mosaic Law, as contained in Exodus, Leviticus, and Numbers. By many scholars assigned to the reign of Josiah, 641–609 B.C.

Deuteroplasm. Modified protoplasm, such as yolk; used as food-material and stored in the form of globules and granules in cells.

Deuterostomata. Group of *Vermes*, including the Chætognaths and Chætopods.

Deuterozoöids. First generation of animals or of cells resulting from the division of primary parent forms.

Deutoplasm. Contents of plant-cells other than protoplasm.

Deutsch, EMANUEL OSCAR MENAHEM, 1829–1873. German Jew, assistant in British Museum from 1855. His article on *The Talmud*, 1867, made a wide and deep impression. *Literary Remains*, 1874.

Deutsch Brod. Town on the Sazawa, Bohemia. Here Ziska and the Hussites defeated the Emperor Sigismund, Jan. 18, 1422. Pop. ab. 5,500.

Deutzia. Genus of shrubs of the natural family *Saxifragaceæ*, with showy white flowers and leaves covered with stellate pubescence; mostly natives of e. Asia; planted for ornament.

Devalokas. Celestial spheres and dwellings of the gods in Hindu mythology. There are six devalokas (worlds in which there is the enjoyment of happiness), and sixteen brahmalokas, where pleasure is more intellectual, verging toward supreme tranquillity and utter unconsciousness.

Devanagari. The ancient alphabet of India, still used there, introduced into Thibet from Kashmir ab. 600. It is inscriptional, in capitals, and a modification of the Pali. Sanskrit is usually written in this character.

Developable Surface. One which can be unwrapped upon a plane; opposed to warped or twisted surface.

Development. The "life-history," embryology, etc., of an animal is termed Ontogeny; the life-history of a species as theoretically presented by the paleontological record is termed Phylogeny. According to the theory of organic evolution the *Metozoa* were evolved from the *Protozoa*. In sexual reproduction each animal starts at the protozoa stage in the ovum, and in some way has to repeat the grades of development of its ancestry along its particular line of descent. This it does so far as it has not been modified by cenogeny. Haeckel holds the view that the ontogeny of any animal is its phylogeny as cenogenetically modified. See CENOGENY.

Development of a Function. Equivalent expression in which operations indicated in the function are performed. Most developments of functions are infinite series. A development is true only when the resulting series is finite or convergent.

Devens, CHARLES, LL.D., 1820–1891. Associate Justice of Mass. 1867–77 and 1881–91; U. S. Atty.-gen. 1877–81.

Deventer. One of the old Hanse towns in Holland on the Yssel, ab. 11 m. from Zutphen. Here Erasmus was brought up and Thomas à Kempis died. Pop. 23,067.

De Vere, AUBREY, b. 1814. Irish dramatic and lyric poet. *The Waldenses*, 1842; *May Carols*, 1857; *St. Thomas of Canterbury*, 1876; *Legends of the Saxon Saints*, 1879; *Essays*, 1887.

Devereux, JOHN HENRY, 1832–1886. Engineer and pres. of Western railroads.

Devexa. See CAMELOPARDELLIDÆ.

Deviation of Projectiles. With smooth bore guns, the departure of the projectile from the plane of fire is the result of many causes, principally the balloting of the projectile on leaving the muzzle, the excentric position of the center of gravity, the unequal air resistance due to rotation, etc. With elongated projectiles the deviation is much less than with spherical balls. In the former the rotation cannot exactly coincide with the axis of figure in any case. The relatively small angular velocity arising from the moment of air resistance with respect to the center of gravity, combined with the great angular velocity due to the rifled motion, produces a resultant angular motion about an instantaneous axis, which is continually shifting and thus changing the direction of the axis of figure of the projectile. The deviation will change with the initial velocity, the character of the rifling, the range, and atmospheric conditions, and therefore the exact solution is a problem of extreme intricacy.

Device. Motto or emblem borne as a cognizance on shields, or embroidered on banners and trappings. In tournaments it was also suspended on the knight's tent as a challenge to all comers. At first devices were confined to royal houses and were typical of the character assumed. The broom-sprig or *planta genista*, emblem of humility, gave its name to the Plantagenets, who assumed this device. The red and white roses are celebrated examples also.

Device of the Prince of Condé, 1662.

Devil, or SATAN. Enemy of mankind and spirit of evil; mentioned five times in O. T. and frequently in N. T.; celebrated in mediæval superstitions, and in *Paradise Lost*.

Devil among the Tailors. Game played with a top or teetotum upon a board on which wooden pins are arranged in numbered compartments, the counts being determined by the numbers of the pins knocked down.

Devil-fish. See CEPHALOPODA and RAYS.

Deville, CHARLES SAINTE-CLAIRE, 1814–1876. Inspector-general of French Meteorological Stations; founder of the Meteorological Society of France, and of the Municipal Observatory at Mount Souris; prof. Paris. *Voyage geologuique aux Antilles*, 1856–64.—His brother, HENRI ETIENNE SAINTE-CLAIRE, 1818–1881. French chemist; prof. Paris 1851. *De l'aluminium*, 1859; *Metallurgie du platine*, 1863.

Devil-on-two-Sticks. Toy formed of two hollow cones of bamboo or metal united at the apex, which is made to spin in the air by a cord passed around the middle. It is said to have been introduced into Europe from China in the early part of this century and became very popular. It is used in Korea by jugglers under the name of Tjouk-pang-oul.

Devil's Apron. Large, broad, dark-green, strap-shaped sea-weeds of the genus *Laminaria*, found abundantly on the shores of the Atlantic.

Devil's Bit. See BLAZING STAR.

Devil's-Wood. *Osmanthus americanus*. Small tree of the Olive family, native of the s. e. U. S.

Devil Worshipers. Various obscure mediæval and modern sects. See YEZIDIS.

De Vinne, THEODORE LOW, b. 1828. American printer. *Invention of Printing*, 1878.

Devon. See CATTLE.

Devon Commission. Created 1844, with Earl Devon as pres., to investigate the condition of the Irish people. It first brought to public notice the abnormal land conditions of Ireland.

Devonian. System or series of fossiliferous rocks, lying between the Silurian and Carboniferous; consisting in Scotland of the Old Red Sandstone; in N. Devonshire the beds are slaty, micaceous, flaggy and sandy; in S. Devon (Plymouth and Torbay), and in Belgium they consist largely of limestone, yielding abundant marine fossils. The conditions under which these beds were formed and the difference in their mineral structure

and fossil remains render their general correlation very difficult. A strong impression prevails that the Red Sandstones are deposits of lacustrine or brackish water. The strata in N.Y. are divided thus: Catskill, Chemung, Portage, Genesee, Hamilton, Marcellus, Corniferous, Schoharie, Cauda-Galli, and Oriskany. In the West the Devonian strata become thinner and almost entirely calcareous.

Devonport. Borough and seaport of s. England, adjoining Plymouth; notable for its dockyard; called Plymouth Dock till 1824. Pop., 1891, 54,736.

Devonshire, SPENCER COMPTON CAVENDISH, LL.D., 8th DUKE OF, b. 1833; better known as Marquis of Hartington. M. P. 1857; member of Gladstone's cabinets 1869–74 and 1880–85; Liberal-Unionist since 1886; Duke 1891.

Devrient, LUDWIG, 1784–1832. German actor, eminent in Shakesperian parts.—Of his nephews, CARL AUGUST, 1797–1872, and EMIL, 1803–1872, were notable actors; PHILIP EDUARD, 1801–1877, was also a singer and dramatist. He edited Shakespeare, and pub. *Hist. German Dramatic Art*, 5 v., 1848–74.

Dew. Vapor precipitated from the atmosphere by cooling.

Dewberry. Trailing blackberry, *Rubus canadensis*, native of e. N. America.

Dew Claws. Claws or hoofs on the feet of cattle, swine, etc., which fail to reach the ground. They are rudimentary and in process of extinction.

D'Ewes, SIR SYMONDS, 1602–1650. English antiquary; Knight 1626, Baronet 1641, M.P. 1640–48. *Journals of Queen Elizabeth's Parliaments*, 1682; *Correspondence*, 1845.

De Wette, WILHELM MARTIN LEBERECHT, 1780–1849. German theologian and commentator; Prof. at Heidelberg 1807, Berlin 1810–19, and Basel from 1822. His liberal views had great influence in America. *Psalms*, 1811; *Jewish Archæology*, 1814; *Dogmatics*, 1813–16; *Introduction to O. and N. T.*, 1817–26, tr. 1843; *Ethics*, 1819–22, tr. 1842; *Theodore* (a novel), 1822, tr. 1849; besides concise commentary on N. T., 1836–48, and tr. Bible, with J. C. W. Augusti, 1809–11.

Dewey, CHESTER, M.D., D.D., LL.D., 1784–1867. Prof. Williams Coll., 1810–27, and Univ. Rochester 1850–60; writer on Caricology. *Herbaceous Flowering Plants of Mass.*, 1840.

Dewey, MELVIL, b. 1851. American librarian; prof. Columbia Coll. 1884; founder of the Library Association and Bureau, of the Metric Bureau, and of the Spelling Reform Association; Sec. Univ. of N. Y., State Librarian 1889.

Dewey, ORVILLE, D.D., 1794–1882. Unitarian pastor in N. Y. and Boston. *Works*, 3 vols., 1847; *Human Life and Destiny*, 1849.

Deweylite. $H_4Mg_4Si_3O_{12}+4aq$. Mineral resembling serpentine; found in Pa. and Md.

DeWitt, JAN, 1625–1672. Dutch statesman, leader of the party opposed to the House of Orange; grand pensionary of

Jan DeWitt.

Holland for 20 years, from 1652. He conducted war with England 1665–67; checked the aggressive plans of Louis XIV. by forming the Triple Alliance with England, Holland, and Sweden 1668; when, later, the French invaded Holland and captured some towns, DeW. became unpopular, and was murdered by a mob, with his brother CORNELIUS, 1623–1672, naval officer.

Dew Point. That temperature at which the air becomes saturated with water vapor. At a lower temperature vapor is deposited.

Dexter. The left-hand half of the Heraldic shield: the upper part is called dexter chief; the lower, dexter base; the boundary, dexter side.

Dexter, HENRY MARTYN, D.D., 1821–1890. Pastor in Boston 1849–67; ed. *Congregationalist* from 1867. He wrote much on New England history. *Congregationalism*, 1865, 1880.

Dexter, SAMUEL, LL.D., 1761–1816. U. S. Senator from Mass. 1799; Sec. War and Treasury 1800–1; eminent as a pleader.

Dextrine. $C_6H_{10}O_5$. British gum; gum substitute; carbohydrate of the starch group, prepared from starch by heating it alone, or in presence of a little nitric acid; white powder, readily soluble in cold water; largely used in the arts as a substitute for gum arabic.

Dextro Compounds. Organic compounds which in a solid state, in solution, or in a gaseous condition, turn the plane of polarization of light to the right. See TARTARIC ACID. Lævo compounds rotate similarly to the left.

Dextrogyrate. Elliptical or circular polarization in which, if the beam be supposed viewed from behind, the ether particles describe their orbits in a clockwise direction.

Dextrorotatory. Doubly refracting crystals, as some specimens of quartz, which are capable of rotating to the right viewed from behind the plane of polarization of a beam of plane polarized radiation.

Dextrose. $C_6H_{12}O_6$. Grape sugar; carbohydrate of the Glucose family, occurring with lævulose in sweet fruits. It crystallizes in plates which melt at 146° C., and in solution turns the plane of polarization of light to the right. It is the main constituent of the grape sugar and glucose of trade, prepared from starch. It ferments easily. See GLUCOSE.

Dextro-Tartaric Acid. See TARTARIC ACID.

Dey. Ruler of Tripoli; of Algiers till 1830, and of Tunis till the title was changed to Bey.

Dhyana. State of abstract meditation leading to the entire destruction of all cleaving to existence. This ascetic rite is practiced by Brahmans and Buddhists; and by its means supernatural powers are attained. In practicing the dhyanas the devotee seats himself upright with crossed legs in a solitary spot and applies his mind to contemplation of the attributes of his deity. To the first dhyana belong reasoning and investigation; to the second, clear mental vision, rejoicing and gladness; third, absolute tranquillity; and fourth, freedom from sensuous attractions, purity and enlightenment of mind.

Diabase. Crystalline granular rock, consisting essentially of triclinic feldspar and augite; also other rocks of analogous composition.

Diabetes. Disease marked by secretion of excessive amounts of urine, called *D. mellitus* and *D. insipidus*, according as diabetic sugar is present or absent from the urine. Both varieties are accompanied by great thirst, voracious appetite (usually), loss of strength and of flesh. *D. mellitus* may be the result of congestion of the liver, the use of large amounts of farinaceous foods and malt liquors, injuries to various portions of the body, mental shocks, and diseases of the nervous system, and is often complicated with boils, diseases of the eye, and consumption. It is often inherited, is most common in middle life, and in males, and is met oftener among Hebrews than other races. It usually results fatally, through exhaustion or coma, in from two to three years. Changes in the liver, kidneys, or pancreas are usually found. *D. insipidus* is oftener seen in men than in women, may be due to injuries of the brain, sudden checking of the perspiration, inordinate use of cold drinks, fatigue, and a host of other causes, but ordinarily to syphilitic disease of the brain. Death is seldom directly due to this variety. *D. mellitus* is readily induced in animals by puncturing a certain point in the fourth ventricle of the brain.

Diacetylene. CH ⋮ C.C ⋮ CH. Gas of peculiar odor, made by heating ammonium diacetylenedicarboxylate with an ammoniacal copper solution, and treating the product with potassium cyanide. Its violet-red copper salt and the yellow silver salt are violently explosive even when moist.

Diadelphia. Linnæan class of plants, comprising those having the stamens united by their filaments into two sets, as in the Bean family.

Diadem. Frontlet worn by ancient rulers. It was made of silk, wool, or yarn, narrow, but wider in the center of the forehead, and generally white. The Egyptian diadem was ornamented with the sacred serpent. The Persian was wound round the tiara and was bluish-white. It was worn by victors in the public games in Greece and by priests and priestesses. As a symbol of kingly power it was hateful to the Romans, and Diocletian was the first Emperor to assume it. After the time of Constantine the Great it was enriched with jewels, and by a constant increase in richness, size, and splendor, was at length converted into the crown.

Diadem.

Diadochi. Successors of Alexander the Great.

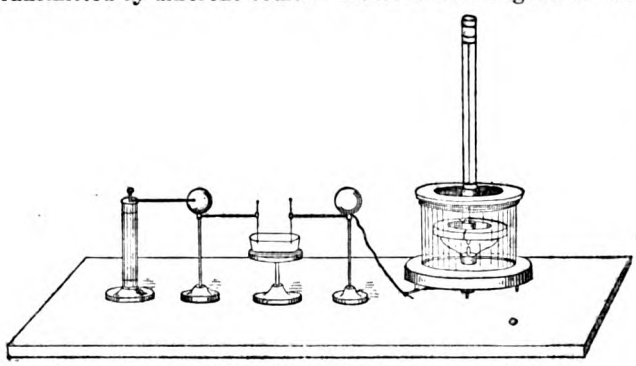
Diæresis. The sign composed of two dots placed over a vowel to show it must be separately pronounced.

Diageotropism. Phenomenon exhibited by the root-stocks of certain plants of assuming a horizontal position in whatever direction they may be placed.

Diagnosis. In Botany and Zoölogy, a short, concise description of a plant or animal. In Medicine, tracing a disease by its symptoms.

Diagnostic Characters. Peculiarities in the structure of an animal which serve to distinguish it from animals in other species, genera, families, etc. They may be specific, generic, ordinal, etc. See CLASSIFICATION.

Diagometer. An instrument invented by Rousseau, in which the dry pile is used to measure the amount of electricity transmitted by different bodies. Palmieri's is designed to test



Palmieri's Diagometer.

the quality of oils and to detect the presence of cotton in silk fabric. It is based upon the principle that olive oil is a poorer conductor of electricity than any other oil in common use. An electroscope determines the relative conductivity of the oil.

Diagonal. Of a plain figure, a straight line joining its vertices not adjacent; in a solid, a straight line joining its vertices not in the same facial plane; in a spherical polygon, an arc of a great circle joining two vertices not adjacent.

Diagonal Bracing. Inclined braces which connect the upper and lower chords of a bridge truss, and through which the loads are transferred to the abutments.

Diagonals of a Determinant. Principal, a line of elements from the first element of the first column to the last element of the last column; secondary, line of elements from the last of the first column to the first of the last column.

Diagoras. Supposed disciple of Democritus, accused of impiety and expelled from Athens 411 B.C. His works in prose and verse have perished.

Diaheliotropism. Leaves which tend naturally to assume a position at right angles to the rays of light, the most common position, exhibit this.

Dialect. Language of any province or community distinguished by certain peculiarities of sound or form from the standard speech of the whole country. Dialects flourished most in early times, through lack of easy communication between provinces. Often a dialect has become a language; *e.g.*, Dutch was once a dialect of the German. In the thirteenth century, English was a mere complex of dialects: there was no fixed literary speech until Chaucer helped to make his dialect, that of London and the Court, standard English.

Dialectics. Art of discussion; that see saw of argument and criticism which can find a unity of conception only in the common principle of contradictory predicates. Thus it results either in a sceptical frame of mind or in the reconciliation of opposites.

Diallage. Greenish cleavable or thin foliated variety of pyroxene, or sometimes varieties of other minerals allied to pyroxene.

Dialling. In English mining, compass surveying.

Dialogue. Form of composition essential to the drama: used by Plato to reproduce and develop the Socratic mode of philosophic inquiry by question, answer, and the clash of wits; largely employed by writers of all ages as a means of instruction and entertainment.

Dials. Instruments for measuring time by means of the heavenly bodies. Sun-dials are very ancient, that of Ahaz is recorded 713 B.C. Anaximander invented another 550 B.C. The first sun-dial seen at Rome was placed on the temple of Quirinus by L. Papirius Cursor 293 B.C., when time was divided into hours. During the Middle Ages every square, courtyard and garden had its sun-dial, which was often very elaborate and frequently encircled by a curious motto, the commonest being, *Horas non numero nisi serenas* (I count only the bright hours).

Dialypetalous. See POLYPETALOUS.

Dialysepalous. See POLYSEPALOUS.

Dialysis. Process of separating certain substances by a method depending upon the fact that solutions of certain compounds will pass through a porous membrane, while others will not; the former are called COLLOIDS (q.v.) and the latter crystalloids. Thomas Graham (1805–69) developed this process.—In Botany, separation of organs, or parts of organs, usually or normally united.

Diamagnetic. Substance having a negative coefficient of susceptibility, and a magnetic permeability less than unity. See MAGNETISM.

Diamesogamous. Flowers which are fertilized by some external agency.

Diameter. Straight line bisecting any system of parallel chords in a curve or surface.

Diameter, APPARENT. Angle at the eye subtended by a heavenly body. The true diameter is easily determined when the distance is known.

Diameters. In Architecture, refer generally to the shaft of a column. The diameters at the base and at the summit, where the shaft is not of equal size throughout, are called the inferior and superior diameters respectively. The module used in determining the proportions of the ordinance is half of the former diameter.

Diametral Curve. One bisecting any system of parallel chords in a given curve.

Diametral Surface. One bisecting any system of parallel chords to a given surface. It may be plane or curved.

Diamide. $NH_2.NH_2$. Hydrazine compound, from which the HYDRAZINES (q.v.) are derived.

Diamidoazobenzene. See CHRYSOIDINE.

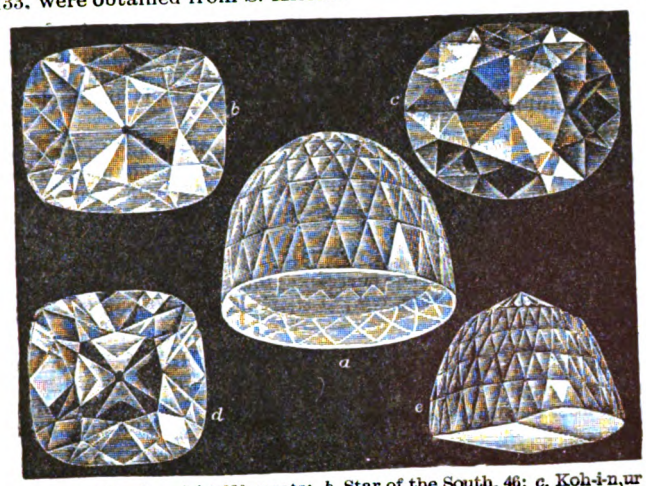
Diamidobenzene. $NH_2.O_6H_4.NH_2$. Phenylenediamine. Known in three forms, ortho-, meta-, and para-diamidobenzenes; prepared by reduction from the corresponding dinitrobenzenes or nitranilines; white solids, oxidizing with great ease; strong bases, forming crystalline salts with the mineral acids. Metaphenylenediamine is used as a test for nitrous acid or nitrites.

Diamidodiphenyl. See BENZIDINE.

Diamines. Organic basic compounds containing two NH_2 groups; also to be regarded as a compound formed from two molecules of ammonia (NH_3) by the removal of one hydrogen atom from each group and the substituting an organic radical for these atoms.

Diamond. Hardest of the precious stones, consisting of the chemical element carbon, either crystallized or uncrystallized, and with a wide range of color and transparency. The most highly valued diamonds are those without flaw, clear and colorless, or having some uniform desirable tint. The richest fields have been those of India and Brazil, and more recently of S. Africa, though the stone has been found in many parts of the world. In the S. African mines the crystals, some of which are broken, occur in a breccia filling the throat of a few old volcanic openings, the surrounding rock being mainly a carbonaceous shale; in other countries the diamond has been found only in alluvial or detrital material. Black diamonds are known as BORT and as CARBONADO (q.v.). A diamond weighing 971¾ carats, more than twice the size of the largest previously known, was found in S. Africa in 1893. The Imperial, found in 1884 in S. Africa, weighs 180 carats and was sold in 1894 to the Rajah of Hyderabad, it is said, for £400,000. From 1882 to

1887 inclusive 14,354,788 carats of diamonds valued at £15,565,133, were obtained from S. Africa.



a, Great Mogul, weight 280 carats; *b*, Star of the South, 46; *c*, Koh-i-nur, 106; *d*, Regent, 136; *e*, Orloff, 193.

Diamond, ARTIFICIAL. Henry Moissan of Paris has made black and translucent diamonds by heating carbon and iron in a crucible to 3000° C. and cooling under great pressure. The diamonds with graphite collect in small pockets in the mass.

Diamond, REGENT. Found at Partral, India; bought 1702 for ab. $96,000 by T. Pitt, Gov. of Fort George near Madras, grandfather of Chatham; wt. 426 carats, cut 137; sold 1717 to Duke of Orleans, Regent of France, for $670,000, of which $200,000 with two caskets of jewels were paid; valued 1792 at $2,400,000; stolen Sept. 17, 1792, recovered Sept. 1793; pawned 1796 and 1798, to raise money for Napoleon's campaigns; redeemed 1802.

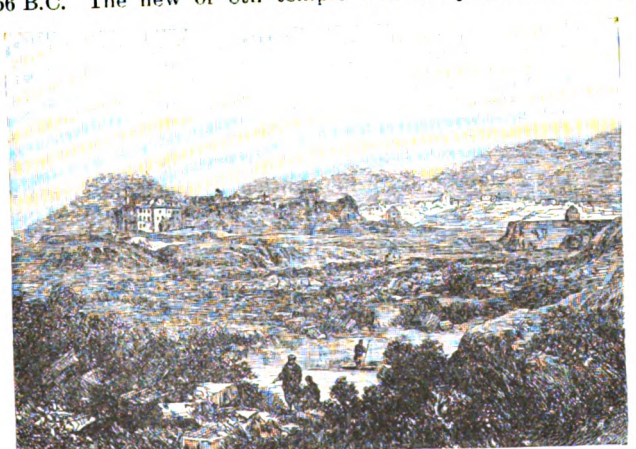
Diamond Drill. Rock-drill for use by prospectors for ores or in trial borings, in which a ring of steel at the end of a tube is studded with black diamond crystals, and made to revolve by a steam engine on the frame. The annular hole made by this ring of diamonds leaves the core intact in the tube, and it can be extracted and examined with little difficulty. A current of water down the tube washes out chips and dust.

Diamond Necklace. Made in Paris 1773–75 for Mme. Du Barry, who never received it; valued at ab. $400,000; used 1783–84 in a vile plot to ruin Marie Antoinette. Cardinal de Rohan was the dupe; Lamotte and his wife were the thieves.

Diamond Saw. Used for cutting and dressing stone. Rough diamonds are set in the steel edge of the saw ab. half an inch apart.

Diana. Roman deity, identified with the Greek Artemis; goddess of the moon, twin sister of Apollo or the sun; as darting rays, transformed into a virgin goddess of hunting. Diana of Ephesus, whose temple was one of the wonders of the world, was originally a distinct deity of Nature, therefore represented as having many breasts.

Diana, TEMPLE OF, AT EPHESUS. Burned by Herostratus 356 B.C. The new or 8th temple was 220 years in building,



Site of the Temple of Diana at Ephesus.

and was 425 ft. by 220, supported by 127 columns, each 60 ft. high, of which 36 were carved, and "each made by a king" (Pliny); four times larger than the Parthenon; one of the Seven Wonders of the World; burned by Goths 262.

Diana of Poitiers, 1499–1566. Favorite of Henry II. of France, though nineteen years his senior; Duchess of Valentinois 1548. Her influence was dominant through his reign, 1547–59.

Diana of Versailles. Fine antique statue of unknown authorship, in the Louvre.

Diandria. Linnæan class of plants, comprising those which have two stamens, as the Lilac, certain grasses, many species of the Mint family, the Speedwells (*Veronica*), Black Pepper, etc.

Diapedesis. Passage of the blood-corpuscles through the walls of the blood-vessels.

Diapensiaceæ. Natural family of flowering plants of the class *Angiospermæ*, sub-class *Dicotyledons*, and series *Gamopetalæ*, comprising 6 genera and ab. 8 species, growing in the e. and n. portions of N. America and the cold regions of the Old World.

Diaper. In Architecture, the decoration of a surface by geometrical figures, square, oblong, or diamond-shaped, in each of which, or at regular intervals, an ornament may be carved, stamped or painted.

Diaphoretic. Increasing the perspiration; remedy or treatment having that effect.

Diaphragm. Midriff or midrib; musculo-membranous partition between the chest and abdomen of man and many other vertebrates. By its contraction and relaxation it assists in respiration, and is sufficient to maintain it for a considerable period.

Diaphragm. 1. Disk with a central hole or series of holes of various sizes and shapes around the edge; used to regulate the light allowed to enter various optical instruments; *e.g.*, the camera obscura. 2. Thin elastic plate used in the telephone, phonograph, and similar instruments to receive or emit the sound waves propagated through the air. 3. The thin porous membrane used in the study of osmose to separate the liquids or gases from each other.

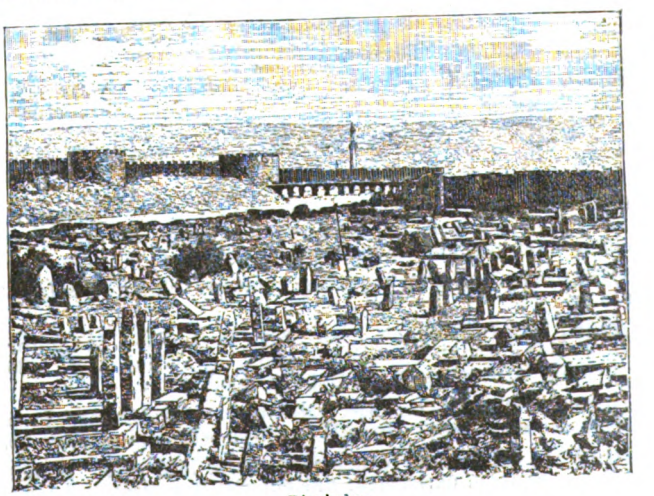
Diaphragm. Thin partition used in a vessel or pipe as a kind of valve.

Diaphragm Currents. Electric currents observed by Quincke; generated when a liquid is forced through a porous membrane by mechanical means; converse of "electrical endosmose," which was discovered by Parret. If a porous diaphragm separate a vessel into two compartments, both filled with water to the same height, a carrying effect, causing a difference of level in the two compartments, may be produced by immersing in the water two platinum electrodes connected with a strong battery.

Diaphysis. Shaft or middle portion of a long bone; first to ossify in the fœtus.

Diapophysis. Projecting articular surface on each side anteriorly of the neural arch of a Vertebra; it articulates with the "tubercle" of a rib. In serpents it is saddle-shaped in its ventral portion so as to allow the rib to swing forward and backward as an organ of progression.

Diarbekir. Anciently Amida. Fortified town on the upper



Diarbekir.

Tigris; seat of several patriarchs; once noted for manufactures; taken by Persians 359 and 502, and by Arabs 640. Pop. ab.

40,000. The town is circular in shape, and is surrounded by high strong walls, flanked with towers, and pierced by four gates.

Diarrhœa. Frequent evacuations from the bowels of fluid or semi-fluid matters. It may be due to cold, undigested food, cathartics, inflammation of the intestines (enteritis), contaminated drinking water, or anything which sets up irritation of the intestines; or it may be a symptom of disease, such as typhoid fever, cholera, or tuberculosis of intestines or peritonæum.

Diary. Daily register of occurrences. Those of the past have extreme historical value in affording contemporary views of various periods. Those of Pepys, Evelyn and Greville in English, and De l'Etoile and Dangeau in French history are celebrated.

Diaspore. $H_2Al_2O_4$. Aluminium hydrate, frequently found with corundum.

Diastase. Nitrogenous compound containing carbon, hydrogen, oxygen, and nitrogen, of unknown composition; produced during the germination of cereals. It acts as a ferment, and by its presence causes starch to change into a sugar, maltose. See MALT, GERMINATION.

Diastema. Space left in the jaw between two adjacent teeth; generally found between the incisors and molars; also called interdental space.

Diaster, or DYASTER. Stage in cell-division in which the mother aster of the nuclear chromatin splits into two similar halves, due to the splitting of each loop composing it.

Diastyle. In Architecture, a wide intercolumniation, as of three diameters.

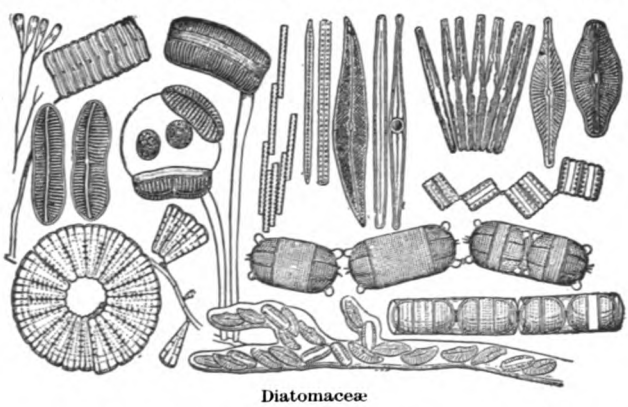
Diatessaron. Narrative of the four Gospels arranged in order of time; attempted by Tatian in 2d century, and often since.

Diathermanous. Body pervious to the dark heat rays, such as are found beyond the red rays in the solar spectrum, or are radiated from any body too cool to be luminous; *e.g.*, rock-salt. Bodies impervious to such radiation are adiathermanous; *e.g.*, solution of alum in water.

Diathermometer. Apparatus invented by Stephan 1872 to determine the coefficient of conduction of gases and liquids. An inner sealed copper vessel serves as an air thermometer to which heat is sent from a larger surrounding vessel through the gas to be examined.

Diathesis. Constitutional tendency to certain diseases.

Diatomaceæ. Order of Algæ; mainly unicellular organisms, having a marked power of motion from place to place,



Diatomaceæ

and consisting of a cell-wall which is extremely silicious, inclosing the protoplasmic contents, including chlorophyll or endochrome; also known as *Bacillariaceæ*.

Diatomin. Brown coloring matter, characteristic of diatoms.

Diaz, BARTOLOMEU, ab. 1450–1500. Portuguese navigator, sent by John II. to explore w. coast of Africa Aug. 1486. Returning, he discovered the Cape of Good Hope.

Diaz, PORFIRIO, b. 1830. Mexican revolutionist; Pres. 1877–80 and since 1884. His rule has been wise and prosperous.

Diaz de la Pena, NARCISO VIRGILIO, 1808–1876. French painter of Spanish parentage; fine colorist in figures and landscapes.

Diaz del Castillo, BERNAL, ab. 1499–ab. 1580. Spanish soldier in Mexico, who described the events in which he took part. His *True Hist. Conquest of New Spain*, pub. 1632, is of high value.

Diazoamidobenzene. $C_6H_5.N.N.NH.C_6H_5$. Mpt. 98° C. Bright yellow plates produced by the action of nitrous acid upon aniline. It is unstable and passes on standing in a liquid into the stable amidoazobenzene. It is insoluble in water, soluble in alcohol and ether.

Diazoamido Compounds. Compounds prepared by the action of nitrous acid upon the amido compounds. They contain the group .N:N.NH. united to two carbon atoms; unstable compounds, which pass readily into the AMIDOAZO COMPOUNDS (q.v.).

Diazobenzene. $C_6N_5.N:N.OH$. Heavy oil, easily decomposing; prepared from the corresponding potassium compound. Its salts are more stable, *e.g.*, $C_6H_5.N_2.NO_3$, but even these explode violently.

Diazobenzenesulphonic Acid. $C_6H_4.N_2.SO_3$. Occurring in three forms. The para compound is made by treating sulphanilic acid with nitrous acid. It is a white, crystalline substance, decomposes on heating, and is used in making dyes.

Diazo Compounds. Containing the group .N:N.; but this group is united with but one carbon atom. Examples, $C_6H_5.N:N.Cl$, diazobenzene chloride. $C_6H_5.N:N.NH.C_6H_5$, diazoamidobenzene. The diazo compounds are characterized by their instability. Many of them explode when touched, and undergo spontaneous decomposition when allowed to stand.

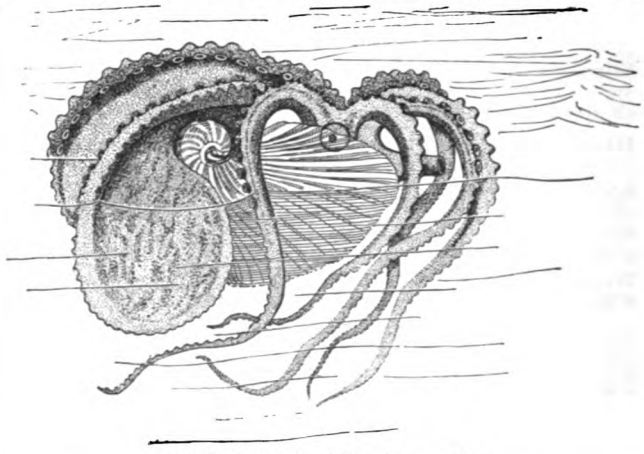
Dibasic Acid. See ACID.

Dibbs. Provincial English name for knuckle bones and the game (jackstones) played with them.

Dibdin, CHARLES, 1745–1814. English composer, theatrical manager, and inventor of "table entertainments," in which he figured as author, composer, actor, singer and accompanist. He produced ballad-operas and many sea-songs, some of them very popular.—His sons, CHARLES, 1768–1833, and THOMAS JOHN, 1771–1841, did work of the same kind.

Dibdin, THOMAS FROGNALL, D.D., 1776–1847; English bibliographer, nephew of CHARLES. *Bibliomania*, 1809–11; *Library Companion*, 1824; *Reminiscences*, 1836.

Dibranchiata (CUTTLE-FISH). *Cephalopoda* with two gills, a complete funnel, an ink-sac, and a circle of arms about the mouth, bearing suckers or hooks. There are two groups. The *Octopoda* have eight arms, bearing sessile suckers and no internal shell (except in *Spirula*); *e.g.*, *Argonauta*, with a delicate, boat-shaped spiral shell and its dorsal arms expanded as fins or



Female Paper Nautilus (*Argonauta*).

sails. The *Decapoda* have in addition to the eight arms two long arms with expanded ends; the suckers are stalked and have horny rims. The eyes have no sphincter-like lids. They have an internal shell and finlike expansions of the mantle. Here belong *Sepia*, *Soligo* (the Squid), and Belemnites (a fossil). The last is known by its internal shell or phragmacone, which is represented in the Squids by the horny "pen" or cuttle bone.

Dibromacetic Acid. $CHBr_2.COOH$. Mpt. 45°–50° C. White crystalline substance, produced by the action of bromine upon acetic acid, acetic ether, or alcohol. It has the general properties of acetic acid.

Dibromanthraquinone. $C_{14}H_6O_2Br_2$. Substance produced either by the action of bromine on anthraquinone, or by the oxidation of dibromanthracene; white solid, giving alizarine when fused with caustic alkali; used at one time in the manufacture of alizarine.

Dibrombenzene. $C_6H_4Br_2$. Three forms, ortho-, meta-, and para-dibrombenzene. The para-dibrombenzene is a white crystalline solid, and is a product of the action of bromine on benzene. Mpt. 87° C., Bpt. 219° C.

Dicasts. Lay judges in ancient Athens.

Dice. Cubes of ivory, bone, or wood; used from remote antiquity for gambling. There are two principal forms, one cubical, marked on its six sides with dots from one to six, and the other in the form of long square prisms. The descent of the first can be traced with much directness to the astragalus or knuckle bone. The sum of the spots on their opposite sides is, with the exception of the dice of the ancient Etruscans, invariably seven. They are of high antiquity, and, although unknown to the Egyptians before the Roman period, they are of common occurrence among early Greek and Roman remains. Long dice survive in India, where they are used in CHANSAR (q.v.) and anciently in Chatinanga, the game of Dice Chess. They are also much employed in a kind of divination, to which, indeed, the origin of all dice may be referred. The number of dice used varies with the game, and they are cast from the hand or a box. They are also used in connection with other games, as BACKGAMMON (q.v.). See ASTRAGALOMANCY.

Dicey, EDWARD, b. 1832. English journalist and historical writer. *Victor Emmanuel*, 1882.

Dichætons. Proboscis (haustellum) of house-fly when formed from two pieces.

Dichasium. Cyme with two axes.

Dichlamydeous. Flowers in which both calyx and corolla are present.

Dichlorhydrine. See CHLORHYDRINE.

Dichogamy. Maturing of the stamens and pistils of a plant at different times, thus preventing self-fertilization.

Dichotomy. Form of division by which a class or genus is divided into two species which are exhaustive of the class; *e.g.*, man into Caucasians and non-Caucasians.—In Botany, forking; division of a vegetable axis into two at its summit.—In Astronomy, aspect of a planet when half the illuminated disk is seen, as the moon at first and last quarter.

Dichotriæne. Form of spicule found in the sponge genus *Coralistes*. It is a triæne, having each of its branches (cladi) forked.

Dichroism. Phenomenon of light absorption, observed in certain transparent media in which the emergent light changes color with an increase of the thickness of the absorbing medium. If, *e.g.*, the incident beam be made up of two colors of intensity, i_1 and i_2, of which the coefficients of transmission are a_1 and a_2 respectively, the intensity of the emergent light for a thickness δ will be in each case $i_1 a_1^{\delta}$ and $i_2 a_2^{\delta}$. Suppose now that $i_1 > i_2$ and $a_1 < a_2$, then at first when δ is small $i_1 a_1^{\delta}$ will be greater than $i_2 a_2^{\delta}$ but will diminish more rapidly with an increase of δ, and finally will become smaller. The thickness at which this change occurs is given by the formula

$$\delta = \frac{\log i_1 - \log i_2}{\log a_2 - \log a_1}.$$

The property is possessed by some crystallized bodies of showing two different colors according to the direction in which the rays of light pass through them. Thus the crystals of the double chloride of palladium and potassium appear deep red along the axis and vivid green in a transverse direction.

Dichroite. See IOLITE.

Dichromatism. In Zoölogy, said of animals producing different colors under normal conditions and not due to change of season, age or sex; *e.g.*, the screech owl, which is either red or gray, young of different colors being found in the same nest.

Dichromic Acid. $H_2Cr_2O_7$. It does not exist in the free condition. The dichromates are derivatives of it.

Dick, JOHN, 1764–1833. Prof. Glasgow 1820. *Inspiration*, 1800; *Theol. Lectures*, 1834.

Dick, ROBERT, 1811–1866. Amateur local geologist in n. Scotland, whose work was of great value in the discovery of fossils in almost barren strata.

Dick, THOMAS, LL.D., 1774–1857. Scottish teacher, pensioned 1847. His *Christian Philosopher*, 1823; *Philosophy of Religion*, 1825; *Celestial Scenery*, 1838; *Sidereal Heavens*, 1840, and others, were long popular.

Dickens, CHARLES, 1812–1870. English novelist; founder of *Household Words*, 1850, and *All the Year Round*, 1859. His first book was *Sketches by Boz*, 1836; most of the others came out in serial form. *Pickwick*, 1837, made him famous. Then came *Oliver Twist*, 1838; *Nicholas Nickleby*, 1839; *Old Curiosity Shop*, 1840; *Barnaby Rudge*, 1841; *American Notes*, 1842; *Martin Chuzzlewit*, 1843. His later works are in a more serious vein: *Dombey and Son*, 1847; *David Copperfield*, 1850; *Bleak House*, 1852; *Hard Times*, 1854; *Little Dorrit*, 1857; *A Tale of Two Cities*, 1857 (his best); *Great Expectations*, 1862; *Our Mutual Friend*,

Charles Dickens.

1865; and a fragment, *Edwin Drood*. He was successful as a reader, and incidentally efficient as a reformer.

Dickinson, ANNA ELIZABETH, b. 1842. American political speaker, actress, and playwright.

Dickinson, DANIEL STEVENS, LL.D., 1800–1866. Lt.-Gov. of N. Y. 1842; U. S. Senator 1845–51; Atty.-Gen. of N.Y. 1861; Dist.-Atty. for s. N.Y. 1865.

Dickinson, DON M., b. 1845. U. S. Postmaster-Gen. 1888–89.

Dickinson, EMILY, 1830–1886. American poet, of recluse life and posthumous fame. *Poems*, 1890; *Letters*, 1895.

Dickinson, JOHN, 1732–1808. Member of the Colonial Congress of 1765 and of the Continental Congress of 1774; author of sundry State papers; Pres. of Pa. 1782–85; founder of Dickinson College.

Dickinson College. At Carlisle, Pa.; founded 1783; controlled by Presbyterians till 1833, since by Methodists. It offers 3 courses, has 9 professors and about 150 students, a library of 30,000 vols., and an endowment of about $350,000.

Diclinous. Flowers in which either the stamens or the pistils are wanting; called also unisexual.

Dicoccous. Dry fruit, separable into two carpels or cocci.

Di Compounds, or BI COMPOUNDS. Compounds in which two radicals or two atoms of hydrogen have been replaced by two other elements or radicals, *e.g.*, dichloracetic acid, $CHCl_2.COOH$, derived from acetic acid by the replacement of two hydrogen atoms by chlorine; dihydroxybenzene, $C_6H_4(OH)_2$; to such compounds as $K_2S_2O_7$, potassium disulphate, in which there are two molecules of the acid anhydride SO_3, united with one molecule of the basic anhydride K_2O; to compounds containing two atoms of an element, carbon disulphide, CS_2, hydrogen dioxide, H_2O_2; also irregularly applied to acid carbonates, acid sulphites, etc., sodium bicarbonate, $NaHCO_3$, sodium bisulphite, $NaHSO_3$.

Dicotyledons. Sub-class of *Angiospermæ*, comprising plants which have two cotyledons in the embryo; also called *Exogenæ*.

Dicotyles. Large extinct Peccary, formerly living in Ohio and the adjoining country. Thirteen fossil specimens of this animal were found some years ago in an excavation in Columbus, O.

Dictator. Extraordinary magistrate of Roman republic, with absolute power for six months; first appointed 501 B.C. to revive regal absolutism in times of great emergency.

Dictionary. 1. Book defining words of any language in alphabetic order; often giving also their derivation and pronunciation. It may be confined to one language, or translate from one into another, as Greek-Latin or French-English. The Homeric lexicon of Apollonius, ab. A. D. 1, is the oldest known. 2. Encyclopædia of information in a single field, as law, biography, anatomy, or hymnology. These are modern.

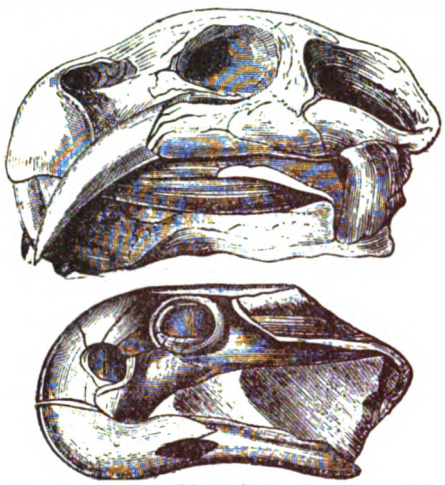
Dictyosiphoneæ. Family of Algæ of the sub-class *Phæophyceæ* and order *Ectocarpaceæ*, including a few marine genera and species.

Dictys of Crete. Historian of the Trojan war; of doubt-

ful antiquity." His work is extant only in a Latin version, probably of 4th century.

Dicyclic Crinoids. Those with two rows of basal plates, the under-basals and para-basals.

Dicynodontia (ANOMODONTIA). Order of extinct (Triassic) Reptiles having biconcave vertebræ, a toothless premaxillary



Dicynodon.
A, Skull of *Dicynodon lacerticeps*, showing the maxillary tusk; B, Skull of *Oudenodon Bainii*. From the Trias of S. Africa.

bone, probably inclosed in a beak like the turtle's, no clavicles, no obturator foramen, and the ischium as well as ilium joining the sacrum.

Dicystidia. See GREGARINIDÆ.

Didactic Poetry. That which aims at instruction in matters literary, moral, philosophic, or other, as Lucretius' *De Rerum Naturâ*, Horace's *De Arte Poetica*, Pope's *Essay on Man*, or Young's *Night Thoughts*.

Didelphia. See METATHERIA.

Didelphidæ. See ENTOMOPHAGI.

Diderot, DENIS, 1713–1784. French philosopher; editor, with D'Alembert, of the *Encyclopédie*, begun 1749 and completed 1777, in 33 vols. His works filled 15 vols. in 1798 and 20 in 1877.

Didius Julianus, 133–193. Roman Emperor who bought the throne from the prætorians, and enjoyed it but 66 days.

Dido, or ELISSA. Daughter of Belus, king of Tyre, and reputed founder of Carthage 853 B.C. Virgil represents her as falling in love with Æneas, though the received chronology separates the taking of Troy 1184 B.C. and the founding of Carthage by more than 300 years.

Didon, J. HENRI, b. 1840. French Dominican, noted for eloquence. *Les Allemands*, 1884; *Jesus Christ*, 1891.

Didot. Family of French printers, whose house was founded by FRANÇOIS, 1689-1757. It has published many valuable works.—FIRMIN, 1764–1836, specially eminent as a printer, engraver, and typefounder, was also a dramatist, translator, and deputy.

Didrachm. Double Greek drachma, equal to the Hebrew shekel, paid by the Jews as a voluntary tribute to the Temple. It was this church-due, not a civil tax, which is mentioned in Matt. xvii. 24–27.

Didron, ADOLPHE NAPOLEON, 1806–1867. French antiquarian. *Christian Iconography*, 1843; *Annales Archéologiques*, 27 vols., 1844–68.

Didunculus. See DODO.

Didymium. See NEODYMIUM and PROSEODYMIUM.

Didymous. Growing in pairs, as the fruits of the Carrot family.

Didymus of Alexandria, called CHALCENTERUS, b. ab. 63 B.C. Voluminous writer on Greek literature.—Another of this name, 308–395, was a blind teacher, head of the famous catechetical school.

Didymus, or **Zwilling,** GABRIEL, 1487–1558. German reformer, adherent of Carlstadt.

Didynamia. Linnæan class of plants comprising those with two pairs of stamens, one pair longer than the other, as in most of the Mint family and the Fox-glove.

Die. Block in the mortar of a stamp-mill on which lies the ore that is to be crushed.—In Coinage, stamp on which the reversed device is engraved, and on which coins are struck.

Die. In Architecture, a cubical stone or mass of masonry, commonly applied to the central part of a pedestal, between the plinth and cornice.

Diebitsch, HANS KARL FRIEDRICH ANTON, COUNT, 1785–1831. Russian general, distinguished in war with Turkey 1829; called Sabalkanski, from his passage of the Balkan Mts.

Diedenhofen, or THIONVILLE. Strongest place on the Moselle after Metz; key of Luxembourg; surrendered to the Duc d'Enghien Aug. 10, 1643; held by France till 1870.

Diefenbach, LORENZ, 1806–1883. Librarian at Solms-Laubach and Frankfort-on-the-Main; prolific author, eminent chiefly in philology. *Celtica*, 3 vols., 1839–40; *Gothic Dict.*, 1846–51; *Originès Europeæ*, 1861; *Dict. High and Low German*, 1874–85.

Dieffenbach, JOHANN FRIEDRICH, 1794–1847. Prof. Berlin from 1832, eminent as an operator. *Surgical Practice*, 4 vols., 1829–35.

Dielectric. Non-conducting medium between two conductors through which the phenomenon of static electric induction takes place. Dielectrics differ in their inductive power or property of transmitting the electric influence. According to Faraday, successive layers of the dielectric become alternately positively and negatively electrified; this condition is called dielectric polarization.

Dielectric Constant. Coefficient by which the inductive power of air must be multiplied to give the inductive power of any dielectric; term suggested by Maxwell.

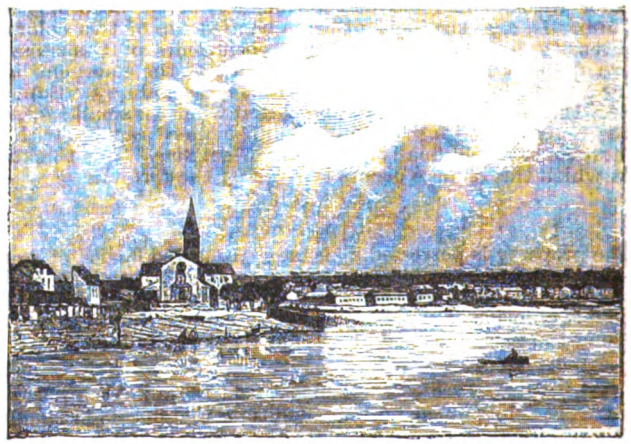
Dielectric Power. Capability of a non-conducting substance to transmit induction; formerly called specific inductive capacity.

Dielman, FREDERICK, b. 1848. N. A. 1883. German-American painter.

Diels, HERMANN, b. 1848. Prof. Berlin 1880. His *Doxographi Græci*, 1879, deals with the early history of philosophy.

Diepenbeck, ABRAHAM VAN, 1607–1675. Flemish painter.

Dieppe. Seaport of n. France; bombarded by the English in 1694, 1794, and Sept. 1803; popular watering-place. It has



Dieppe.

manufactures of watches, linen, lace, paper and ivory wares. Distilling, fishing and ship-building are important industries. Pop., 1891, 22,359.

Dies Iræ. Latin hymn, ascribed to Thomas of Celano, composed 13th century, vividly descriptive of the day of judgment; probably suggested by Zephaniah i. 15. It forms a portion of the R. C. mass for the dead. Of 150 or more English versions, the best is by W. J. Irons, 1848.

Dies Non. Not a court day; holiday, treated by the law as not existing.

Diessenhofter. In Canton Thurgau; scene of a victory by Swiss peasants over nobles, 992. See STEIN, HEINZ VON.

Diesterweg, FRIEDRICH ADOLF WILHELM, 1790–1866. Director of normal schools at Frankfort 1813, Mörs 1820, and Berlin 1832–47; pensioned 1851; deputy 1859. *Pestalozzi*, 1846.

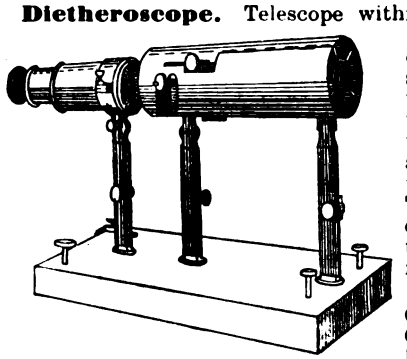
Diet. Assembly of delegates meeting day by day for legislative or administrative purposes. That of the German Empire met twice a year, and was made up of three colleges: the elec-

tors, who chose the Emperor; the princes of the realm; and the representatives of the free cities, admitted 1648.

Dieterici, KARL FRIEDRICH WILHELM, 1790–1859. Prof. Berlin 1834; economist. His *Statistics of Prussia*, 1858, was carried further by his son, FRIEDRICH, b. 1821, prof. Berlin 1850, author of works on the Arabs, 1868–75, and *Darwinism*, 1878.

Dietetics. Study of food with reference to health.

Dietheroscope. Telescope within which reflectors or total reflecting prisms or additional lenses are so introduced as to cause two images of an object to appear in the field of view, which images separate from each other when the object moves. The apparatus is adapted to the accurate measure of refractions in mirage.



Dietheroscope.

Diethylaniline. $C_6H_5.N(C_2H_5)_2$. Bpt.204° C. Liquid produced by heating aniline with ethyl bromide; much used in the manufacture of coal-tar colors. Commercial ethylaniline is a mixture of mono- and diethylanilines.

Dietrich, ALBERT, 1795–1856. Custodian of the Royal Gardens in Berlin. *Flora regni Borussici*, 1833–44; *Botanique für Gärtner und Gartenfreunde*, 1837–39.

Dietrich, CHRISTIAN WILHELM ERNST, 1712–1774. German painter. As belonging to the 18th century his name ranks fairly well. In any earlier time he would be unknown.

Dietrich, DAVID NATHANAEL FRIEDRICH, b. 1800. German botanist. *Flora universalis*, 1831–56; *Flora medica*, 1881; *Lichenographia Germanica*, 1832–37; *Deutschlands Flora*, 1833–42; *Encyclopädie der Pflanzen*, 1841–53; *Zeitschrift für Gärtner, Botaniker und Blumenfreunde*, 1840–50.

Dietrich, PHILIPPE FREDERIC, BARON DE, 1748–1793. French mineralogist, economic geologist, and writer of a treatise on the ores of France.

Dietrichsen, LORENTZ HENRIK LEGELCKE, b. 1834. Norwegian critic.

Dietz, FEODOR, 1813–1870. German painter of army life and battles.

Dieulafoy, MARCEL AUGUSTE, b. 1844. French engineer and explorer, noted for his excavations at Susa and the discovery there of the enameled tile work representing a procession of the Persian guard, now in the Louvre. *Ancient Art of Persia*, 1884–89; *Acropolis of Susa*, 1890. His wife shared his labors, and has pub. *At Susa*, 1887.

Diez, FRIEDRICH CHRISTIAN, 1794–1876. Founder of Romance Philology; prof. at Bonn from 1830; author of *Grammar and Dictionary of the Romance Languages*, 1836–53.

Difference, or DIFFERENTIA. Characteristic by which a species is separated from the genus, as Caucasians from Man.

Difference Engine. Mechanical reckoner in which the method of differences is used in calculating. The Scheutz and Babbage calculators are operated on this principle. See CALCULATING MACHINE.

Difference Series. One the differences of whose successive terms either are constant, or form a series whose differences as before are constant, or form a third series, ultimately resting upon a constant difference. The order of the series depends upon the number of steps prior to the constant relation. A series of the first order has its first difference constant and is an arithmetical progression. Analysis of the series gives: where a is the first term, d_1 d_2 d_3 etc. to d_n the first terms of the successive differences and n the number of terms (the last term) $a_n = a + (n-1)\,d_1 + \frac{(n-1)(n-2)\,d_2}{\lfloor 2} + \frac{(n-1)(n-2)(n-3)\,d_3}{\lfloor 3} +$ etc., and for the sum of n terms $S_n = n\,a + \frac{n(n-1)\,d_1}{\lfloor 2} + \frac{n(n-1)(n-2)\,d_2}{\lfloor 3} +$ etc. To solve a difference series of the nth order (n + 1) consecutive terms must be given.

Differential. The differential of a function or variable at any value is what would be its increment in any interval of time if at that time its change became uniform. The symbol for a differential is the letter d placed immediately before the function or variable, as du, $d(x^2)$, read differential of u, differential of x^2.

Differential Coefficient. Ratio of the differential of a function to that of its independent variable; also called the derivative.

If $u = f(x)$, $\frac{du}{dx} = f'(x)$.

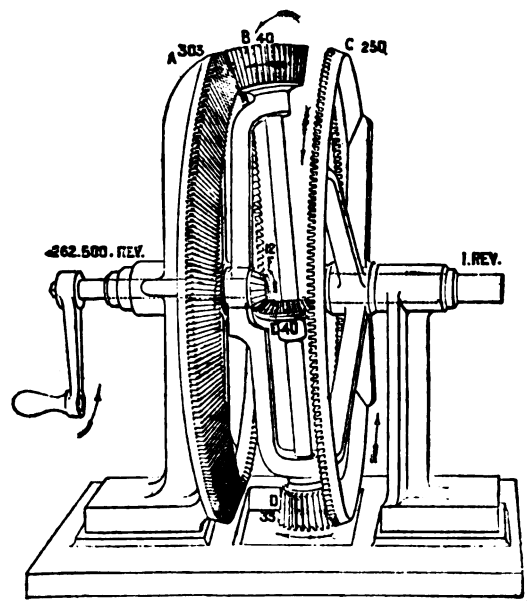
If $u = x^4$; $du = 4x^3dx$: therefore $\frac{du}{dx} = 4x^3$

$\frac{du}{dx}$ is the differential coefficient.

Differential Equations. Those involving differentials of variables and their functions. They are classified according to the degree and order of the differential elements. Partial differential equations express the relation between the partial differentials of a function of two or more variables.

Differential Galvanometer. Two equal and separate wires are coiled around the same needle; through these wires currents may be sent in opposite directions. If these be equal the needle remains at rest; if either predominate, the needle is deflected. See GALVANOMETER.

Differential Gear. Arrangement of toothed wheels such that, with a given angular velocity for the driver shaft, the angle through which the driven shaft turns is the difference in



Differential Gear.

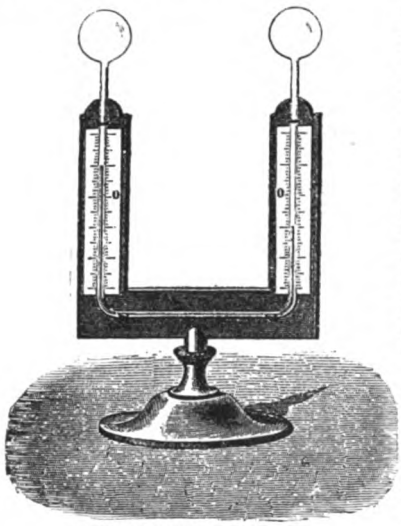
the length of the circumferences of two wheels. By making this difference small, a small power can be made to overcome a great resistance, but of course at slow speed. In the cut the figures indicate the number of teeth, one revolution of C requires 262,500 revolutions of A.

Differential Partial. If a quantity be a function of two or more variables, its differential in respect to one of the variables, the others being considered constant, is a partial differential.

Differential Pulley. Known also as Weston's Pulley-block. Starting with the hauling bight, the chain passes up over a sheave in the upper block, down around the lower sheave, up over a smaller pulley in the upper block, and descends to complete the slack bight. By this method of roving the chain, the lower sheave rises in one turn of the upper sheave through a distance equal to the difference in the circumferences of the large and small sheaves in the upper block, these two sheaves turning together and being usually in one piece. The height to which such a pulley will lift is necessarily limited by the amount of chain necessary, but for short lifts it gives great power, and the load will not run down when the hauling chain is released.

Differential Screw. Combination of two screws of different pitch, so that one revolution of the screw moves the load through the difference between the pitches. Usually one screw works inside the other on the same axial line, and the screw of smaller pitch is left-handed. When the screws are both female, and are to draw two male threads together, they will both be right-handed.

Differential Thermometer. An instrument used for measuring very small differences in temperature. It consists of two glass bulbs connected by a glass tube as shown in the figure. The tube is partly filled with alcohol colored with litmus extract. It was invented by Leslie, and enabled him to make important investigations on the radiation of heat. It is not meant to indicate the difference of temperature of the atmosphere but indicates the difference of temperature between the two tubes.



Differential Thermometer.

Differential Tone. Composite sound or resultant tone whose vibration frequency corresponds to the difference of the vibration frequencies of the two component tones.

Differential Total OF A FUNCTION OF TWO OR MORE VARIABLES. Differential on the supposition of simultaneous change in all the variables. It equals the sum of the partial differentials.

Differentiation. Process in Differential Calculus of finding the differential of a function in terms of the differential of its variable or variables. All functions may be differentiated. See DIFFERENTIAL.

Differentiation. In Economics, that subdivision of functions which consists in the division of labor and the specialization of skill and of instruments; as characteristic of highly developed communities as it is of individual organisms.

Differentiation. Divergence in character of living things that start as homogeneous or similar units, but in the course of their life become dissimilar.

Differentiation, SUCCESSIVE. If the first derivative is a function of the variable, this can be differentiated, and so on until a constant is reached. Successive differentiations give second, third, etc., derivatives.

Diflugia. See ARCELLINA.

Diffraction. Change in direction which light suffers when it passes by the edge of a solid body or traverses a small aperture. The phenomena are explicable on the ordinary principles of interference.

Diffraction of Object-Glass. A fixed star is practically a geometrical point having no measurable diameter; its image, however, seen through a telescope, is not a point, but a small round "spurious" disk, surrounded by rings, growing fainter from the center outward. This effect is due to the properties of light. The disk diminishes as the size of the object-glass is increased. The apparent diameter for one inch aperture is 4."5, for 4.5 inch aperture 1"; hence one of the advantages of large glasses.

Diffusion. Irregular reflection or refraction of light, or that action by which a surface becomes visible.

Diffusive Power. When light is incident upon a reflecting surface, a part is absorbed, a part is reflected regularly, and a part is reflected irregularly or diffused. The ratio of the light diffused to the whole quantity incident is the diffusive power of the surface.

Diffusivity. Tendency in a body to an equalization of temperature throughout its mass. It varies directly as the conductivity of the substance, and inversely as its specific heat.

Digallic Acid. See TANNIN.

Digamma. Sixth letter of earliest Greek alphabet; obsolete in the classical period, except in the provinces. It reappeared in Rome as F, coming from Eubœa, and among the Greeks as the number 6.

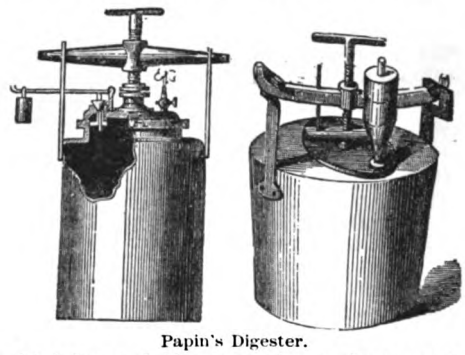
Digby, SIR KENELM, 1603–1665. English author, who joined the R.C. Ch. 1636. *Body and Soul*, 1644.

Digby, KENELM HENRY, 1800–1880. Anglo-Irish R.C. author. *Broad Stone of Honor*, 1826–27; *Mores Catholici, or Ages of Faith*, 1844–47.

Digenous Reproduction. That in which interaction of two sexes is needed to produce offspring; also termed Gamogenesis.

Digest. Abridgment or compendium of laws; especially the Roman law, collected in Justinian's Pandects.

Digester. Metal vessel with a detachable cover which can be screwed down tightly. It is used in chemical operations to raise the boiling fluid to a higher temperature than 100° C. It has been raised to 204° C. and above. Also employed in obtaining gelatine from bones, in preparing soups, rendering lard and tallow from the offal in slaughter-houses, etc., which cannot be done at ordinary temperatures. Invented by DENIS PAPIN (q.v.), 1681. See AUTOCLAVE.



Papin's Digester.

Digestion. Process or processes to which food is subjected preparatory to its absorption into the system. By the saliva a portion of the starch is converted into sugar; by the gastric juice secreted by the stomach the food is disintegrated, and some of the albumens and albuminoids converted into peptones, the whole mass being known as chyme; after passage into the intestines, the remainder of the albumen and starch are converted respectively into peptones and maltose, the fat saponified or emulsified by the action of the bile and pancreatic and intestinal juices, giving rise to a milky fluid, the chyle. Fat is absorbed by the lacteals, and the remaining constituents by the blood-vessels. The indigestible residue of the food, with some of the waste products of the body, constitute the fæces. Animal digestion lies at the root of all discussions of fodders and cattle-feeding, but as yet is imperfectly understood.

Digestive Apparatus. Mouth, throat, œsophagus (gullet), stomach, intestines and their glands secreting fluids which effect digestion, pancreas and liver.

Digger Indians. Aborigines of California, so called from their habit of digging in the earth for worms, etc., to eat. They were once very numerous, but have rapidly declined. Complexion more swarthy than other Indians, less energetic and less warlike in disposition, filthy in person, without conception of God, but fearing evil spirits; they stand lowest among N. American Indians.

Diggings. Localities in Cal. where mining on auriferous placers is carried on.

Digit. One of the ten numbers, 0 to 9.—Twelfth part of diameter of sun or moon.—Width of a finger, ab. ¾ inch.

Digitalin. $C_{32}H_{38}O_9$. Glucoside occurring in the leaves of the *Digitalis purpurea;* needles almost insoluble in water, but very soluble in benzene.

Digitalis. Genus of scrophulariaceous herbs, of which the *D. purpurea* or FOXGLOVE (q.v.) is used in medicine as a heart-stimulant and diuretic. It depends for action upon a glucoside, digitalin.

Digitigrada. See FISSIPEDIA.

Diglyceride. See GLYCERIDES.

Digoneutic. Insects producing two broods in a year.

Digonopora. Marine *Dendrocœla*, having the proboscis in a special pouch, and, sometimes, two tentacles on the head, also, often, many eyes. They are closely related to the Planarians.

Digonous. Two-angled. In Botany, certain flat stems.

Digynia. Orders of plants which have two pistils.

Dihedral Angle. Formed by two intersecting planes, or by the revolution about a fixed line of a plane from one position which remains fixed to any other position. The fixed line is the edge of the dihedral angle; the two positions of the plane are the faces of the angle, one initial, the other terminal. Its measure is the plane angle formed by straight lines in the respective faces perpendicular to the edge at any point: this is also called the plane angle of the dihedral.

Dijon. Town of e. France, at junction of the Ouche and Suzon; capital of Burgundy 1007–1477, when it fell to France

Dijon.

The Swiss besieged it 1513; Germans took it Oct. 1870. It is a center of the Burgundy wine trade. Pop., 1891, 62,307.

Dike. Embankment made to prevent the inundation of low land. One of 37 miles in length surrounds the site of the former Haarlem Lake in Holland, which was reclaimed by pumping 1839–52.

Dilambodont Dentition. Molars of northern *Insectivora*, having two V-shaped ridges.

Dilemma. Form of argument which makes either alternative of a thesis equally fatal to the assertion of it.

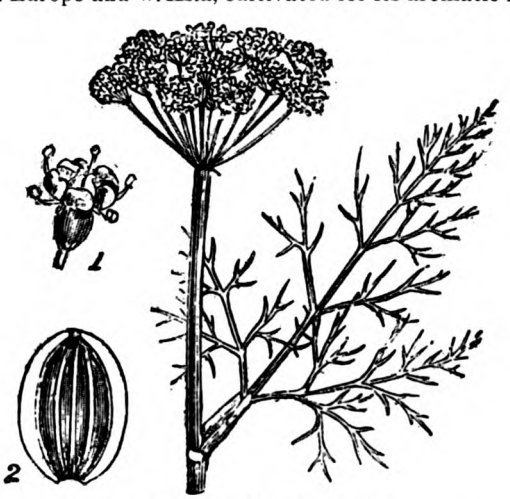
Dilettante. Lover of Art. The word is generally used disparagingly to signify a would-be connoisseur, or one whose paraded taste and judgment is mere affectation.

Dilettanti, Society of. Founded 1734 in England by lovers of art. It sent Chandler and Revett to Greece 1764–66, and pub. *Antiquities of Ionia*, 4 vols., 1769–1881, and other works.

Diligence. Public conveyance drawn by four horses and divided into three compartments, capable of accommodating fifteen passengers; used in France, Spain, and Italy.

Dilke, Sir Charles Wentworth, b. 1843. English author; M. P. 1868–86 and 1892; cabinet minister 1882. *Greater Britain*, 1868; *British Army*, 1888.—His wife, Emilia (Strong), b. 1842, widow of Mark Pattison, pub. *Claude Lorraine*, 1879, and *Art in the State*, 1888.

Dill. *Anethum graveolens.* Herb of the Carrot family, native of s. Europe and w. Asia, cultivated for its aromatic fruits.



Common Dill. 1. Flower; 2. Fruit.

The seeds, when distilled with water, furnish an oil which is used as a carminative, generally in the form of dill-water.

Dillen, John Jacob, 1687–1747. German-English botanist, prof. Oxford 1728. *Hist. Mosses*, 1741.

Dilleniaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledons*, comprising 18 genera and ab. 200 species, widely dispersed throughout the tropics and in Australia.

Dillmann, Christian Friedrich August, D.D., 1823–1894. German Orientalist; prof. at Kiel 1854–64. Giessen 1864–69, and from 1869 at Berlin. He pub. commentaries on the Pentateuch, 1875–86, and an Ethiopic grammar, lexicon, and chrestomathy, 1857–66.

Dillon, John, b. 1851. Irish nationalist; M. P. 1880–81 and from 1885; thrice imprisoned.

Dillon, John Forrest, b. 1831. Judge in Iowa 1858–1869; U. S. Circuit Judge 1869–79; prof. Columbia Coll. 1879–82. *Municipal Corporations*, 1872; *Municipal Bonds*, 1876.

Diluvial Theory. Hypothesis that fossils were all buried in the solid strata of the earth by Noah's flood; fallacy of the 17th and 18th centuries, which, checking accurate observation and the systematic classification of facts, seriously retarded the progress of geological science.

Diluvium. Now called the Drift; formerly supposed to have been deposited by a violent flood of water from the North. This belief maintained its ground for many years, in spite of its manifest impossibility. It was ultimately displaced by the glacial theory.

Dimensioning. Process of finding the sizes of members of structures in order that they may carry the given loads with the proper degree of security. The principles of statics and of the strength of materials are its basis.

Dimerous. Flowers constructed on the plan of two members of each circle of parts, or binary plan.—Tarsi of insects, when two-jointed.

Dimethylaniline. $C_6H_5N(CH_3)_2$. Bpt. 192° C. Liquid with an odor like that of aniline. By heating aniline salts with methylalcohol under pressure, a mixture of mono- and dimethylaniline is produced, which is the methylaniline of trade. It is usually mainly dimethylaniline. Mild oxidizing agents convert it into methyl violet. Dimethylaniline is largely used in producing artificial colors.

Dimethylbenzene. See Xylenes.

Dimethyl-Ketone. See Acetone.

Dimidiate. Anthers of a flower when one of the two normal cells is abortive or suppressed; also leaf-blade developed only on one side of the midvein; also calyptra of mosses split along one side.

Dimidiation. Original method of Impalement in Heraldry, or forming a compound shield by uniting the dexter-half of one divided shield with the sinister-half of another.

Diminished Angle. That between the exterior side of a fortification and the line of defense; so-called because the exterior angle of polygonal plan is diminished by this amount on each front.

Diminishing Final Utility, Law of. Statement that every increase in the supply of an object of desire lessens one's eagerness for more of it.

Diminishing Returns, Law of. Statement that the application of successive increments of capital and labor to land will ultimately add a less than proportionate amount to the produce raised from it.

Dimorphism. Differentiation of a species into two sorts of organisms, as for instance sexual (males and females) or seasonal, in which an individual presents two forms, as in many birds, having one sort of plumage in summer, another in winter. A variety of this is seen in the change which animals undergo during rut. The first meaning is the more usual.

Dimorphism. The presence on plants of the same species of two different kinds of hermaphrodite flowers, adapted for cross-fertilization, as in the Partridge Berry, *Mitchella repens.*

Dimple. 1. Depression of the mercury in the barometer tube when the atmospheric pressure is diminishing. 2. Depression in the surface of the mercury when the measuring point of a barometer dips into the surface.

Dimsdale, Thomas, 1712–1800. English physician, who inoculated Catherine of Russia and others with small-pox, 1768 and 1784, and urged the practice.

Dimyaria. Group of Lamellibranchs, including the *Homomyaria* and *Heteromyaria.*

Dinah. Daughter of the patriarch Jacob; regarded by Ewald as denoting a tribe enticed by the Canaanites out of the Israelitish confederacy.

Dinan. Picturesque French town in Brittany on a steep bank of the Rance R., 14 m. s. of St. Malo. It was the seat of the old Dukes of Brittany whose castle is now used as a prison. Its church contains the heart of Bertrand du Guesclin. Pop. 9,788.

Dinant. Belgian town ab. 15 m. s. of Namur, on the right bank of the R. Meuse. Pop., 1891, 7,048. It is very picturesquely situated among precipitous cliffs with a castle at the summit. It has a fine old 13th century square-towered church

adorned with two notable porches. D. suffered greatly during the wars of the 15th and 16th centuries. In 1466 Philip the Good, Duke of Burgundy, sacked the town and cast 800 of its

Dinant.

rebellious citizens into the Meuse; and in 1554 it was again pillaged by the Duke of Nevers. The French also seized it in 1795. Its leather manufactures have always been famous.

Dinarchus, b. ab. 361 B.C. Corinthian orator at Athens, imitator and opponent of Demosthenes; in exile 307–292 B.C.

Dinas Brick. Siliceous, refractory brick made from the so-called Dinas stone of Wales. Used in metallurgical furnaces.

Dindorf, CARL WILHELM, 1802–1883. Prof. at Leipzig, 1828–33; editor of the Greek dramatists and of lexicons to Sophocles and Æschylus.—His brother, LUDWIG, 1805–1871, was a classical philologist.

Dindymene. Cybele; so named from a mountain in Phrygia sacred to her.

Dines, WILLIAM HENRY, b. ab. 1840. English meteorologist, author of many anemometric investigations.

Dingelstedt, FRANZ, 1814–1881. German poet, dramatist, novelist, translator of Shakespeare, and director of theaters at Weimar and Vienna. *House of Barneveldt*, 1850.

Dingo. Native dog of Australia. It is wild, and exists as fossil in the Quaternary strata, but is the only placental mammal of that continent not introduced by man, unless, as seems probable, a prehistoric race introduced it. It is 2 ft. high, 2½ ft. long, black to dark-brown. It is fierce and commits great depredations on flocks of sheep. See CYNOIDEA.

Dinichthys. Genus of huge placoganoid fishes chiefly from the Devonian Shales of Ohio. The jaws of the largest species are two feet in length, ending in front in a strong, sharp, upturned point. Some species, as *D. terrelli*, had jaws constructed like a pair of shears. Little is known of any part except the head. Many plates from other parts of the body have been found, but with a few exceptions their arrangement is an unsolved problem. *Dinichthys* must have been one of the most formidable of the armor-clad fishes of its time, the plate covering the back of the head being in large individuals 3 to 6 inches thick. Ab. 12 species are already known, showing great differences of form. Of the few species found outside of Ohio, one occurs in Belgium.

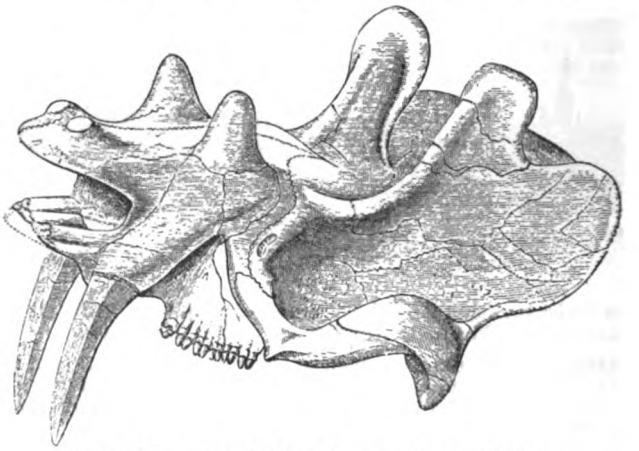
Dinifera. Order of *Cilioflagellata*, naked or with shell, of asymmetrical shape, with a transverse groove (sometimes several) in which a flagellum plays, and often a longitudinal groove and second flagellum also. *Ceratium tripos* is an example. See CILIOFLAGELLATA.

Dinitrobenzene. $C_6H_4(NO_2)_2$. Three forms are known, but the article of trade is the metadinitrobenzene. It is a solid which crystallizes in long colorless needles, melting at 90° C., and is produced from benzene by the action of fuming nitric acid or of a mixture of nitric and sulphuric acids. On reduction it yields metanitraniline, and then phenylenediamine.

Dinitronaphthalene. $C_{10}H_6(NO_2)_2$. Product of the action of strong nitric acid upon naphthalene. It consists mainly of the so-called dialpha-compound, is a very insoluble substance, and crystallizes from acetic acid in yellow needles.

Dinitronaphthol. $C_{10}H_6N_2O_5$. The salts of dinitro-α-naphthol are known in trade as Martius' yellow, naphthol yellow, etc.; yellowish substance, prepared by the action of nitric acid upon α-naphthol or α-naphthol sulphonic acid. The salts are used as yellow dye-stuffs.

Dinoceras. Elephantine though trunkless animal of the Middle Eocene of America, having two or three pairs of horns



Skull of Dinoceras mirabile. From the Eocene Tertiary.

or hard protuberances, immense tusks, and small brains; also called Unitatherium, Tinoceras, and Loxolophydon.

Dinocerata. See AMBLYPODA.

Dinoflagellata. See CILIOFLAGELLATA.

Dinornithidæ. Order of *Ratitæ*, including very large New Zealand birds, incapable of flight, such as the Moa, Dinornis, and Æpyornis. They seem to have become extinct recently. Some of the remains indicate an immense size of skeleton and of eggs. See ÆPYORNIS.

Dinosaur. Family of enormous Mesozoic animals, foreshadowing both birds and mammals, and seemingly the culmination of the reptilian type. Some were herbivorous, others carnivorous. Many of them were bipeds.

Dinosauria. Group of bird-like Reptiles represented by Jurassic fossils and mud tracks. *Hadrosaurus* had a pavement of teeth adapted to the mastication of vegetation. It attained a length of 28 feet and used its relatively short arms to pull down the branches of trees to its mouth, while it stood on its large hind legs, of which the thigh bone was 40 inches long. In Europe is found, in the Wealden strata, perfect remains of *Iguanodon*, which stood 14 feet high, with an enormously strong tail 14 feet long projecting behind. It left three-toed tracks. This was herbivorous; but *Lælaps*, which resembled a kangaroo and attained a height of 18 feet, was carnivorous, had large lance-like teeth, and probably was the king of beasts of its day. See CAMAROSAURUS and BRONTOSAURUS.

Dinotherium. Huge European elephant of the Miocene

Dinotherium, as restored by Kaup.

Age, having two enormous tusks, directed vertically downward, and a short trunk.

Dio Cassius. See DION CASSIUS.

Diocese. Territory in the jurisdiction of a bishop.

Dio Chrysostom. See DION CHRYSOSTOM.

Diocletian, CAIUS VALERIUS AURELIANUS, 245–313. Roman Emperor 284–305. He associated with himself Maximian as Augustus 286, Constantius and Galerius as Cæsars 292, and divided the administration among the four, retaining the East. He abdicated with Maximian 305, and spent his last years in retirement. He sought to compel uniformity in religion; and by advice of Galerius issued an edict against Christians 303 which led to relentless persecution, ending with the victory of Constantine 312.

Diocletian Era. 284–ab. 510. See DIONYSIUS EXIGUUS.

Diodati, GIOVANNI, 1576–1649. Swiss Calvinist of Italian parentage, prof. at Geneva 1597–1645. His Italian version of the Bible, 1607, is still used.

Diodon. See PLECTOGNATHI.

Diodorus Siculus. Flourished 1st cent. B.C. Author of a universal history in Greek, in 40 books, of which 15 and fragments of others remain. While not a critical writer, he is valuable through fullness of detail, and his style is clear.

Dioecia. Linnæan class of plants, comprising those having dioecious flowers, as the Willows, Poplars, Mistletoe and Hemp.

Dioecism. Production of stamens and pistils on different plants, as in the Willows.

Dioecious. Plants bearing staminate flowers on some individuals and pistillate on others, as the Willows.

Diogenes, ab. 412–323 B.C. Cynic philosopher, celebrated for his ascetic teaching and habits, contempt of men, and blunt manners. Being captured by pirates on a voyage to Ægina, he was sold as a slave to Corinth, but was liberated a short time afterward.

Diogenes

Diogenes Laertius. Greek of unknown date and place, who wrote gossiping and sketchy *Lives of Philosophers*, valuable for its anecdotes.

Diogenes OF APOLLONIA, 5th century B.C. Teacher at Athens; his book is lost. Air was the first principle of his system.

Diognetus. EPISTLE TO. Christian letter of unknown authorship, variously dated from 150 to 310.

Diolein. See OLEINS.

Diomedes. Son of Tydeus, next to Achilles bravest of the Greeks before Troy. He fought with Hector, Æneas, and Mars, and helped Ulysses to carry off the Palladium.

Dion, ab. 408–354 B.C. Syracusan; pupil of Plato. He was banished, but returned 357, expelled Dionysius the younger, and was slain.

Dion Cassius, called COCCEIANUS, 155–ab. 235. Roman historian, who held office from Commodus to Alex. Severus, and was twice Consul. His *History of Rome* extended to 229, and consisted of 80 books, of which we possess fragments of the first 24, books 36–54 entire, an abridgment of 55–60, 4 parts of 71 and 75. The work was modeled upon Thucydides, and is of considerable value.

Dion Chrysostom, ab. 50–ab. 117. Greek author and teacher at Rome, favored by Nerva and Trajan; 80 of his orations or treatises survive, and are valued for their thought and style.

Dione. Titaness, mother of Aphrodite by Zeus.

Dionysia. Greek festivals in honor of the god Dionysus. They were celebrated with rejoicing, and accompanied with processions and choral songs. From the Dionysiac chorus at Athens sprang the public performances which developed into the drama and its elaborate compositions.

Dionysius, ab. 430–367 B.C. Tyrant of Syracuse from 405. He extended his sway in Sicily by victories over the Carthaginians, and annexed a part of s. Italy; a poet and a patron of literature, but in later life suspicious and crafty. His "Ear" was a dungeon in the rock so contrived that he could hear every word and sigh of his prisoners.—His son reigned 367–357, when he was driven out by DION (q.v.), but regained his power 346; was deposed 343, and retired to Corinth. Both invited Plato to Syracuse.

Dionysius. Bp. of Rome 259–269.

Dionysius Exiguus (THE LITTLE), d. ab. 556. Monk of Scythian birth, abbot at Rome. He edited the Canons and Decretals, and arranged the calendar, beginning our era (as it still is) ab. 4 years too late.

Dionysius OF ALEXANDRIA, ab. 200–264. Convert and helper of Origen; Bp. 247; exiled 257–260; canonized. His day in Greek Ch. is Oct. 3, in Latin Nov. 17.

Dionysius OF HALICARNASSUS, ab. 50 B.C.–ab. A.D. 10. Greek author, resident at Rome from ab. 29 B.C. His Roman history, entitled *Archæologia*, recounted the story of Rome from its foundation down to the Punic Wars, and comprised twenty books, of which we have eleven nearly complete, and portions of the later ones. He wrote also criticisms of ancient authors, and rhetorical works.

Dionysius Periegetes, 2d century. Greek poet, whose versified *Description of the Earth* was much used by the Romans.

Dionysius THE AREOPAGITE. Member of the supreme Athenian tribunal; one of St. Paul's converts at Athens; first bishop there, and martyr. His name has been fictitiously attached to a Neoplatonizing treatise of great influence in the Middle Ages.

Dionysius THE CARTHUSIAN, 1403–1471. Belgian theologian.

Dionysius Thrax, ab. 100 B.C. Greek grammarian who taught at Rhodes and Rome. His work on grammar laid the foundation for all that came after.

Dionysus. In Greek Mythology, the god of the vine. The story of his birth is only a mythical representation of the growth and ripening of the grape. He taught men how to cultivate the vine and instituted orgastic ceremonies. Five different gods "Dionysus" of different parentage have been accounted for. See BACCHUS.

Dionysus (Bacchus).

Diopatra. See ERRANTIA.

Diophantine Analysis. Method of solving indeterminate problems, particularly those relating to square and cube numbers and to the linear elements of a right triangle: named from Diophantus.

Diophantus, ab. 410–330 B.C. Mathematician of Alexandria. We have fragments of a work by him on polygonal numbers, and 7 books out of 13 of *Arithmetica*, which, except the Papyrus of Ahmes, is the earliest work on Algebra extant.

Diopside. Variety of pyroxene, containing but little aluminium.

Dioptrate. Eyes of certain aquatic beetles, divided by a transverse mark.

Dioptre. Unit of refraction used in measuring spectacles and the refraction of the eye. It is the amount of refraction produced by a lens of a focal length of one metre.

Dioptrics. Department of optics which treats of the phenomena produced when rays of light pass from one medium into another of different optical density.

Dioptric System. See REFRACTING SYSTEM.

Diorama. Painting viewed through an opening by means of light thrown upon it much as with the PANORAMA (q.v.): introduced in Paris 1822, by Daguerre. Changing scenes and moving figures produce a realistic effect.

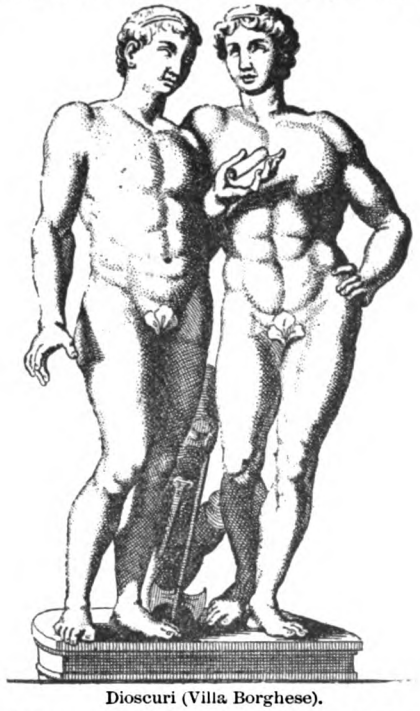
Diorite. Crystalline granular rock consisting essentially of triclinic feldspar and hornblende; also other varieties of rock.

Dioscoreaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Monocotyledons*, comprising 9 genera and ab. 170 species, distributed throughout the warmer parts of the globe. Called the Yam family.

Dioscorides, PEDANIUS, 2d century. Of Anazarbus in Cilicia; Greek author of a work on materia medica, mentioning above 500 plants, and not improved on till modern times. It was tr. into Latin, Spanish, French, Italian, and German.

Dioscuri (CASTOR AND POLLUX). Homer makes them sons of Leda and Tyndareus, and brothers of Helen. C. was famed

for his skill in managing horses: P., in boxing. They are protectors of sailors, presidents of the public games, and inventors



Dioscuri (Villa Borghese).

of the war dance. Some make them sons of Zeus and Leda, born from the same egg as Helen.

Dioxindole. $C_8H_7NO_2$. Mpt. 180° C. Colorless prisms, readily soluble, made by reducing isatin with zinc dust and hydrochloric acid and extracting with ether.

Dioxy Acids. Dihydroxy acids; acids containing two alcoholic hydroxyl groups; *e.g.*, COOH.CHOH.CHOH.COOH, tartaric acid.

Dioxybenzenes. $C_6H_4(OH)_2$. Dihydroxybenzenes. The orthodioxybenzene is pyrocatechin, the metadioxybenzene is resorcin, the paradioxybenzene is hydroquinone. See these titles.

Dip. Slope or pitch of inclined strata. The angle made with the horizon is called the angle of inclination or dip. See MAGNETIC INCLINATION.

Diperiodic Acid. $H_4I_2O_7$. Not known in the free condition. The diperiodates are derivatives of it.

Dipetalous. Corolla consisting of two petals.

Diphenic Acid. $C_{12}H_8(COOH)_2$. Mpt. 229° C. Dibasic acid derived from diphenyl; white crystalline compound prepared by the oxidation of orthoditolyl.

Diphenyl. $C_6H_5.C_6H_5$. White crystalline hydrocarbon, melting at 71° C.; prepared by passing benzene vapors through a red hot tube. It is present in coal tar, and furnishes benzoic acid upon oxidation.

Diphenylamine. $(C_6H_5)_2NH$. White crystalline substance of fragrant odor and burning taste, melting at 54° C. and boiling at 310° C.; produced by heating aniline salts with aniline; used in producing artificial colors. See AURANTIA.

Diphenylamine Blue. $C_{37}H_{30}N_3Cl$. Triphenylrosaniline hydrochloride, prepared by the action of oxalic acid on diphenylamine; insoluble in water, soluble in alcohol; formerly used in dyeing cotton and silk blue.

Diphenylmethane. $CH_2(C_6H_5)_2$. Mpt. 26° C., Bpt. 272° C. Hydrocarbon derived from methane; colorless needles, soluble in alcohol and ether. Its odor resembles that of oranges. It is made by heating benzene and benzylchloride in the presence of aluminium chloride.

Diphilus. 3d century B.C. Attic dramatist of the New Comedy; author of 100 plays, of which we possess fragments.

Diphtheria. Acute, infectious, constitutional, febrile disease, characterized by the formation of a white or gray membrane upon mucous or raw surfaces, which is difficult or impossible of detachment, and by general prostration. The parts most commonly the seat of the membrane are the throat, nose or eyelids, although it has often been seen upon raw or abraded surfaces in any locality. It is very fatal, death resulting from suffocation or the failure of the vital powers. Paralysis of various muscles and albuminuria often persist for months after an attack, but usually disappear. It is due to a micro-organism, *Bacillus diphtheriæ*, producing a poisonous body, to which the constitutional symptoms are attributable. Recently inoculations of antitoxin, the serum of horses, rendered insusceptible to the disease by repeated injections of cultures of the bacillus, have been employed in the treatment and prevention of this disease with reported brilliant results, the mortality having been greatly diminished, though many deaths are said to have occurred among those inoculated after exposure to the disease. While it is too early to speak authoritatively on the subject, it seems probable that inoculation with properly prepared cultures is justifiable and of value. See ANTITOXIN.

Diphthong. Combination of two vowels, usually short, uttered with one breath. Some of the so-called vowels are really diphthongs, the most evident being *i* in *bite*, as compared with the genuine vowel in *bit*. See VOWEL.

Diphycercal. Form of tail fin of fishes in which the notochord extends out straight and has as much fin on its dorsal side as on its ventral; also called Protocercal. Compare HOMOCERCAL.

Diphyes. See CALYCOPHORIDÆ.

Diphyllous. Plant bearing two leaves only, or calyx or corolla consisting of only two leaves (sepals or petals).

Diphyodont Dentition. Two sets of teeth, as in most mammals.

Diplanetism. Spores of certain Fungi which have a resting period between two periods of motility.

Diplarthra. Order of *Eutheria* with non-deciduate placenta. See ADECIDUATA. Usually known as *Ungulata* in a restricted sense. They form two groups, the Odd-toed (*Perissodactyla*) and the Even-toed (*Artiodactyla*). The inside toe is always wanting, except in *Coryphodon*, which has all the mammalian digits and is therefore by some placed in a separate suborder (*Teleodactyla*). The nail on the tip of the toes is developed into a hoof. Clavicles are absent. There are two sets of teeth (diphyodont): the molars have broad, grinding crowns. All are herbivorous and have been designated the *Herbivora*, and by some authorities divided into *Uniungulates*, *Biungulates*, *Multiungulates*, etc., according to the number of hoofs: with these groups were included the *Proboscidea* and *Hyracoidea*. They were also known as *Pachydermata* or thick-skinned animals.

Dipleura. *Zygopleura* with but two antimeres. They constitute the group which includes the ordinary bilateral animals. In this group the Flounders (*Pleuronectes*) have lost this symmetry, becoming asymmetric, in ordinary terms; but Hæckel treats this as the most evolved form of symmetry, viz., the *Dysdipleura*, and puts all the other Vertebrates, also the Mollusks, Anthropods, etc., into the *Eudipleura*.

Diplobacteria. See PAIRED BACTERIA.

Diploblastic Blastoderm. One having two layers of cells.

Diplococcus. See COCCUS BACTERIA.

Diplodal Rhagon. Type of sponge in which there are both incurrent and excurrent canals, and each ampulla is connected with the former by a prosodus and with the latter by an aphodus.

Diploë. Spongy tissue between the two outer, compact layers of flat bones.

Diploma. Anciently, charter or letter from a Roman Emperor or other prince; now, certificate of graduation in a college.

Diplomacy. Art of conducting intercourse between governments; managed in all European countries by men specially trained for the purpose and constituting a distinct profession.

Diplomatic Agents. Accredited representatives of sovereign governments, as Ambassadors, Envoys, Ministers, and Chargés d'Affaires.

Diplomatics. Science or art of deciphering ancient documents; begun by Papebroeck ab. 1675, and Mabillon, in *De Re Diplomaticâ*, 1681; also called Palæography.

Diploperistomous. Sporanges of mosses which have the cilia or teeth of the peristome in two series.

Diplopia. See DIPLOPY.

Diploplacula. Two-layered placula.

Diplopodous. Having two pairs of legs on each segment, as in Myriapods.

Diplopola. See MONAXONIA.

Diplopterous. Having fore-wings folded longitudinally, as in Wasps.

Diplopy. Affection of the eye by which two images of an object instead of one are formed on the retina, so that things appear double. It is probably due to some malformation of the crystalline lens, which causes a bifurcation of the rays of light. When three images are formed, the disease is called Triplopy.

Diplospondilous. Vertebræ separated by intercentral pieces that resemble vertebræ but lack ribs and arches, as in certain fishes.

Diplospondyli. See PLAGIOSTOMI.

Diplostemonous. Flowers which have two series of stamens, these being normally double the number of the divisions or lobes of the calyx.

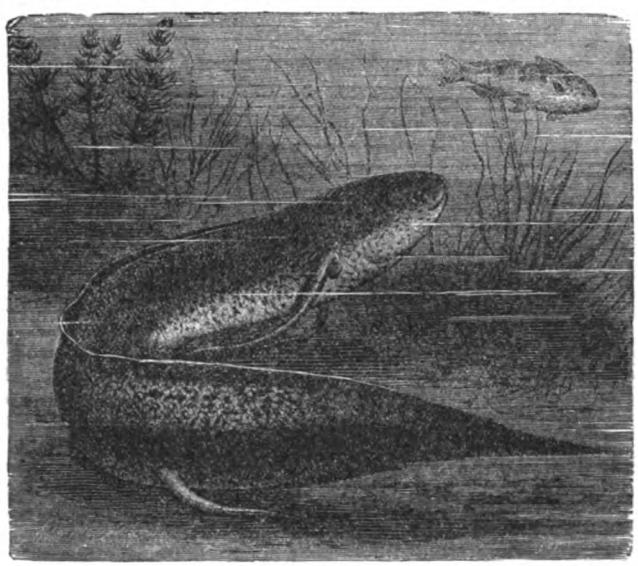
Diplostichous. Eyes of insects having two layers of cells, an outer vitreous and an inner retinal one. The non-retinulate are always monomeniscous, as seen in ocelli. The retinulate are monomeniscous (central eye of *Limulus*) or polymeniscous, as in ordinary compound eyes.

Diplotegium. Fruit which is adnate to the calyx tube.

Diplozoön. See POLYSTOMEA.

Dipneumona. Holothurians with two respiratory trees and with the ambulacral rows never double. See APODA.

Dipneumona (PNEUMONOPHORA). Sub-order of *Dipnoi*, including fishes, with narrow paired fins, with rays on only one side of the cartilaginous jointed shaft. There are less than four pairs of internal gills, and the conus arteriosus has a valvular arrangement by which the blood is divided so that part goes to the lungs and part to the aortic or branchial arches, as in *Amphibia*. Two genera are included: *Protopterus* of Africa,



Dipneumona (*Protopterus annectens*).

which retains three external larval gills, above the branchial cleft, for a considerable portion of its life; and *Lepidosiren*, of Brazilian rivers, which has no external gills. It has an independent urinary bladder; and neural and hæmal arches are formed upon its persistent notochord.

Dipneumones. See ARANEIDA and SPIDERS.

Dipneusta. Fishes allied to the *Amphibia*, as *Protopterus*, *Lepidosiren* and *Ceratodus*, which breathe by gills in water, but can live on land also for a considerable time, the moist gills being aided by simple lungs. See DIPNOI.

Dipnoi (PROTOPTERI). Scaly fishes with both branchial and pulmonary respiration, with persistent notochord and cartilaginous cranium, over which may be bony plates. They have a muscular conus arteriosus, and a spiral valve in the intestine. They form a connecting link between the *Ganoids* and *Amphibia*. The swim-bladder functions as a lung, receiving a blood-vessel from the posterior aortic arch. A cloaca is present. The nasal sacs open into the anterior part of the mouth. The pelvic fins are placed far back; both pairs of fins have a central, jointed shaft, and lateral rays. There are two sub-orders, the *Monopneumona* and the *Dipneumona*. See DIPNEUSTA.

Dipodidæ. See MYOMORPHA.

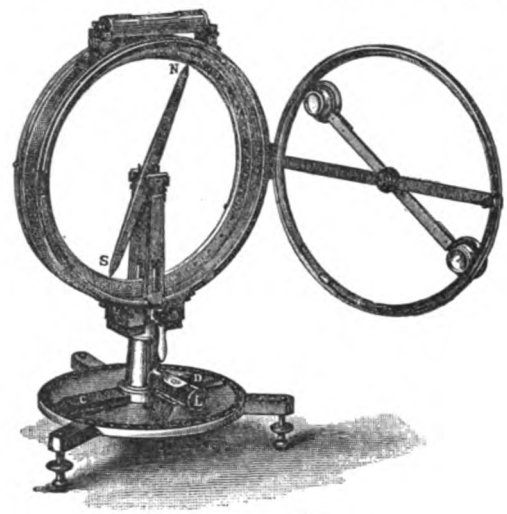
Dip of the Horizon. Depression of the visible horizon at sea below the true level, due to the height of the observer above the water. To find the dip multiply the square root of the height of the eye above the water expressed in feet by 58.8; the result will be the dip in seconds of arc approximately.

Diporpa. See POLYSTOMEA.

Dippe, MARTIN CHRISTIAN, 1813–1878. Director Statistical Bureau of Schwerin; author of hypsometric tables and memoirs on Isobars and Winds.

Dipper. Popular name for the seven chief stars of the constellation Ursa Major; a similar figure in Ursa Minor is called the Little Dipper.

Dipping-Needle. The inclination or dip of the magnetized needle was discovered by Robert Norman 1576. It consists of a vertical graduated circle in the plane of which a delicate magnetic needle is suspended on a horizontal axis. The circle is set in the plane of the magnetic meridian and the



Dipping-needle.

needle indicates upon the graduated circle the angle of inclination. Ross reached the magnetic pole, lat. 70° 5′ 17″ N., long. 96° 46′ 45″ W., 1831. The amount of inclination was 89° 59′. The dip varies at different parts of the earth's surface and at the same place at different periods. See MAGNETOMETER.

Diprionidian. Having polyps arranged in two rows on opposite sides of the stem, as in some *Graptolites*.

Dipropargyl. $CH{:}\ C.CH_2.CH_2.C{:}\ CH$. Bpt. 85° C. Hydrocarbon isomeric with benzene; made by heating dibrom diallyl with alcoholic potash. It yields silver and copper derivatives.

Diprotodon. Extinct enormous pachydermoid kangaroo found in Australian caves.

Diprotodontia. Group of Marsupials having two incisor teeth in the lower jaw, rudimentary canines, and broad crushing crowns to the molars. Three tribes are included, *Rhizophaga*, *Poœphaga*, and *Carpophaga*.

Dipsaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledons*, and series *Gamopetalæ*, comprising 5 genera and ab. 150 species, distributed through all parts of the Old World. Called the Teasel family.

Dip Sector. A reflecting instrument used for ascertaining the true dip of the horizon. Similar in principle to the SEXTANT (q.v.). One invented by Troughton, another by Wollaston.

Dipsomania. Uncontrollable desire for alcoholics, in some instances amounting almost to a disease. See ALCOHOLISM.

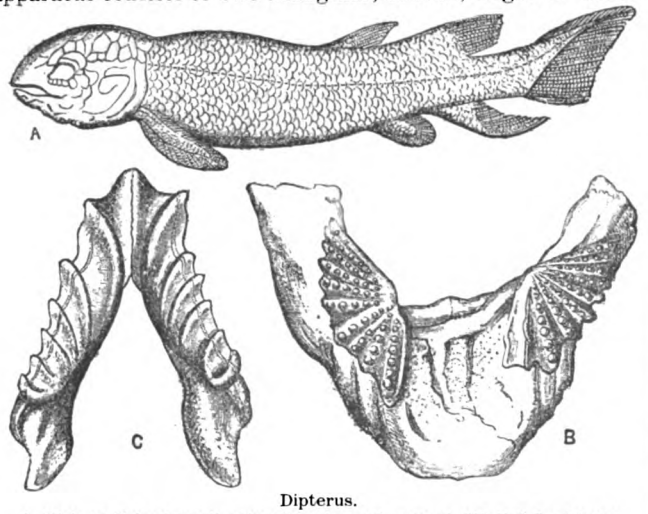
Diptera (ANTLIATA FLIES). Order of *Insecta* with large glossy transparent front wings, and the hind pair as halteres. The mouth parts (the labium, principally) form a haustellum, and the jaws and epipharynx are modified to form pumping or piercing organs. The abdomen has 5 to 9 segments; the legs frequently end with sucking disks. Metamorphosis is complete, the larva being generally a footless maggot. There are four sub-orders: *Pupipara*, *Brachycera*, *Nemocera*, and *Aphaniptera*.

Dipteral. In classic architecture, denotes a building having two complete ranges of columns all round. The Greeks are said to have constructed such temples, but the only remaining sample is the temple of Jupiter at Athens, a Roman work.

Dipterocarpaceæ. Natural family of flowering plants, of the class *Angiospermæ*, and sub-class *Dicotyledons*, comprising 15 genera and ab. 180 species, distributed through the tropics of the Old World.

Dipterus. Crossopterygian lepidoganoid fish of the Devonian, with the two dorsal fins placed directly over the ven-

tral and anal, and a well ossified internal skeleton. The dental apparatus consists of two triangular, convex, ridged or tuber-



Dipterus.

A, *Dipterus Valenciennesii*, reduced in size and restored, Old Red Sandstone; B, front portion of the lower jaw of *Dipterus platycephalus*, Old Red Sandstone, viewed from above and showing the dental plates; C, Mandible of *Ctenodus imbricatus*, viewed from above, showing the dental plates, from the Carboniferous.

culated plates, attached to lower jaw and a pair of similar plates attached to the roof of the mouth. See CERATODUS.

Diptych. In old Roman use, a double or two-leaved writing tablet, whose inner sides were spread with wax, on which the writing was done with a pointed stick or stylus. These, with decorative carved covers, were subsequently presented by Consuls to friends on occasion of their election to office, and contained their portraits and titles. The early Christians employed similar diptychs, also with decorative carved outer surfaces, for recording the names of bishops, martyrs and saints; these were read aloud to the congregations at church services. Ivory was a material much employed for these by the late Romans and early Christians, and these ivory carvings are an important connecting link between antique and mediæval art.

Dipylon Vases. Named from the Dipylon Gate at Athens, near which several important specimens were found. Oldest style of Greek vases, decorated with geometric patterns, geese, deer, and horses. The human figure appears only in late examples. Dates range from the prehistoric period to 6th century B.C.

Diræ. See FURIES.

Direct Cell Division. That in which the nucleus simply constricts into two halves, followed by a similar behavior of the cell plasma. See REMAKIAN SCHEME.

Direct Development. Of an egg into a young animal (that is, practically like the adult) by a gradual, more or less rapid, and continuous process. There are no breaks in the life history, no larval stages of any permanence, no metamorphosis nor alternation of generations.

Direction Cells, or Corpuscles. See POLAR BODIES.

Directive Force. One tending to cause a body to take up a position in some particular plane, but having no effect to cause translation, *e.g.*, the earth's magnetic force, which causes a magnetic needle to take up a position in the magnetic meridian, but causes no motion of the center of gravity.

Directly Proportional. Quantities which increase or decrease together; opposed to inversely proportional.

Director. Manager of a corporation; generally elected by the stockholders.

Director Plane. One to which all the right-lined elements of a warped surface are parallel.

Directory. Body of five men who exercised executive authority in France from Oct. 26, 1795, to Nov. 9, 1799; chosen by the Council of Elders from a list nominated by the Council of Five Hundred; overthrown by Napoleon.

Directory. Alphabetic list of inhabitants of a city or town, with their addresses; first pub. in London 1677, and in New York 1786.

Directory for Public Worship. Set forth by Westminster Assembly and ratified by English Parliament 1644; adopted Feb. 6, 1645, in Scotland, where parts of it are still followed.

Directrix. Fixed line to which the movement of a point generating a locus is referred, or which controls the movement of a line generating a single curved or warped surface.

Dirge. Song of grief or mourning; funeral hymn from Ps. v., used in R. C. Ch.

Dirhem. Silver coin of Caliphs of Bagdad from ab. 800; also wt. of 45 grains, applied to jewels and medicine in Persia, Arabia, etc.; in Turkey now equal to the gramme.

Dirhem of Haroun el-Raschid.

Dirichlet, PETER GUSTAV LAJEUNE, 1805–1859. Prof. Math. at Berlin 1828, and Göttingen 1855. Works, 1889–90.

Dirichlet's Principle. Theorem, in English books attributed to Lord Kelvin, "that there always exists one, but no other than this one, function, v, of x, y, z, which, (1) is finite, continuous, and single-valued, together with its first space derivatives, throughout a given closed region L; (2) at every point of the region satisfies the equation $\nabla^2 v = 0$ (see POTENTIAL FUNCTION); and (3) at every point on the boundary of the region has any arbitrarily assigned value, provided this can be regarded as the value at that point of a single-valued function which has derivatives finite, continuous, and single-valued all over this boundary."

Dirt-Beds. Old vegetable soils, occurring interstratified with the oölitic limestones and sandstones in England and Nova

Dirt-Bed, Isle of Portland.

a, fresh-water calcareous slate; *b*, dirt-bed with stools of trees; *c*, lowest fresh-water beds of the lower Purbeck; *d*, Portland stone, marine.

Scotia, containing the stumps of trees which once grew in them, Cycads and Conifers predominating. They are from 14 to 18 inches thick.

Dis. Pluto, god of the lower world.

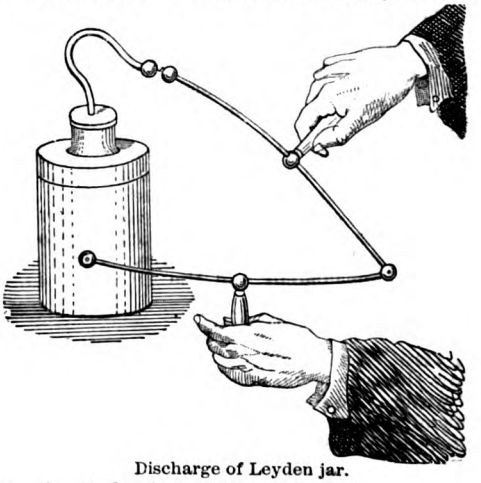
Disability. Legal incapacity to incur obligations or to exercise rights; absolute, as in case of civil death; partial, as in case of infants and married women.

Disbar. Depriving of the right to practice at the Bar; a discipline exercised by the benchers of the Inns of Court in the case of unprofessional conduct in a barrister; in U. S., exercised by the Court.

Discant. Musical term introduced by the harmonists of 11th or 12th century, originally meaning double-song. It was then an added voice to a given melody. Later it came to mean the soprano part in a composition, and hence also the tune or air.

Discharge, COEFFICIENT OF. Ratio of the actual discharge through an orifice to the theoretic discharge. For an orifice in a thin plate its value is ab. 0.61, for orifices with rounded edges between 0.61 and 1.00. For weirs and pipes special tables of coefficients are used, which have been derived from experimental researches.

Discharger. Instrument for discharging a Leyden jar or battery, consisting of two curved brass rods joined by a hinge



Discharge of Leyden jar.

and terminating in knobs. At or near the hinge is attached an insulating handle.

Discharging Arch. In Architecture. an arch turned over a lintel, in order to relieve it by discharging the superincumbent weight upon the flanking walls.

Disciples of Christ. American denomination, known also as Christians and Campbellites. originating 1811. They are immersionists, and adhere to the letter of Scripture. Pres. Garfield was one of them. Membership ab. 800,000; ministers, 5,500; congregations, 8,400, chiefly in the middle West.

Disciplina Arcani. Reserve of the early Ch. as to sacraments, and exclusion of non-communicants from the Eucharist, these being too sacred to be known by the uninitiated.

Discipline. In Ethics, the performance of actions rather from a regard to their influence in the formation of habits and character than from their own value or immediate moral nature.

Discipline, Books of. For Ch. of Scotland. First, prepared 1560 by Knox and 4 others; Second, by Melville and others 1578; not ratified by Parliament.—The M. E. Ch. has a similar book, revised quadrennially.

Disclaimer. Renunciation of a claim or relative.

Discoblastula. Blastula stage of mesoblastic egg.

Discobolus. See Discus.

Discocarps. Sporocarps of the *Discomycetes;* also called Apothecia.

Discocephali. Sub division of the *Teleocephali*, including the *Echeneidæ*, of which *Remora* is type. These fishes have the dorsal fin modified into a sucker, extending over the top of the head, by means of which they attach themselves to larger fish and to ships. Africans and West Indians have been reported to use this fish for catching other fish and turtles, a string being fastened about the tail. These fish are kept captive and respond to a call of their masters.

Discocytula. Mesoblastic egg when segmentation nucleus is formed.

Discodactylia (*Hylidæ*, Tree Frogs). Tribe of *Phaneroglossa*, including forms having the tips of toes provided with sucking disks. *Hylæformia* are *Hylas* with teeth on the maxillaries; *Hylaplesiformia* have no teeth. There are 175 species of tree frogs, all noted for their loud nocturnal singing. Some undergo remarkable changes of color, resembling the surface they happen to be on. The eggs are laid in small packets in water or on plants, but *Nototrema* of Peru has a pouch on its back into which the eggs are crowded and undergo their development. *Phyllomedusa* has grasping hands and feet like those of Lemurs.

Discogastrula. Mesoblastic egg in the gastrula stage.

Discoidal Placenta. See Placenta.

Discoidea. Genus of Clypeastrid. fossil sea urchins. See Diciduata.

Discoidea.

Discoidea cylindrica, an "irregular" Echinoid. Right-hand figure shows summit of shell, with genital disk. Left-hand figure shows base of shell, on which are situated both mouth and anus. Cretaceous.

Discoid Markings. See Bordered Pits.

Discolith. Calcareous body imbedded in Bathybius, a slimy deposit on deep sea bottoms.

Discomedusæ. See Discophora and Scyphomedusæ.

Discomorula. Mesoblastic egg in morula stage of development.

Discomycetes. Division of Fungi belonging to the subclass *Ascomycetes*, characterized by having their sporocarps open and the asci thus exposed to the air.

Discontinuous Function. One in which for successive values of the independent variable imaginary values occur intermediate to real values.

Discophora (Ephyramedusæ, Steganophthalmata). Disk-shaped Acalephs, whose margin is divided into eight lobes, in the niches between which are eight sense organs, each covered by a lobe. As a rule there are four large cavities in the sub-umbrella for the generative organs. They form the groups: *Semæostomeæ*, *Cubomedusæ*, and *Rhizostomeæ*. Sometimes termed *Discomedusæ*, *Ephyroniæ*, or *Octomeralia*.

Discophora (Leeches). See Hirudinea.

Discoplacentalia. See Placenta.

Discord. Combination of sounds which are inharmonious, unsatisfying or painful to the ear. See Dissonance.

Discostomata. *Choanoflagellata*, including ampullary cells of sponges as well as certain Flagellates. The former are *Cryptozoida*, the latter *Gymnozoida*.

Discota. See Insecta Discota.

Discount. Allowance made for the payment of money before it is due. It is properly the difference between the face of the debt and the sum which at interest for the given time would equal this face. The latter sum, the present worth, equals the face of the debt divided by one dollar plus the interest on one dollar for the given time.

Discount, Bank. Interest on the face value of a loan, calculated for the time of the loan, and deducted from the amount loaned. The latter is called the proceeds.

Discounted Value. Valuation of a future pleasure or utility, as compared with its value if enjoyed immediately.

Discovery Shaft or Tunnel. That in which an ore deposit is proved to exist in a mining claim.

Discrete Proportion. One in which the ratio of the second term to the third is not that of the first term to the second; opposed to Continued Proportion.

Discretion. Power to decide a case according to one's best judgment, having due regard to established principles of jurisprudence and to the circumstances of the case.

Discriminant. The discriminant of an equation of the nth degree in one unknown is the resultant of this equation and its first derivative. The vanishing of the discriminant shows that the original equation has equal roots. The discriminant of a quadric is the determinant whose elements are the constants of the quadric, and whose vanishing is the condition that the quadric is the product of two first degree factors

Discus. Circular stone or metal disk ab. 12 in. in diameter used as an exercise of strength and dexterity among the Greeks. It was thrown like a quoit and the longest cast won. The famous statue of a discus-thrower (Discobolus), by Myron, a Greek sculptor, has been frequently copied. The figure is from the Vatican.

Discobolus.

Disease. Condition of body in which vital processes deviate seriously from their normal healthful action. Slightly marked deviations are termed affections or disorders; denominated acute when coming on rapidly and with severity; chronic when slow in course; sub-chronic when intermediate between above; constitutional, general or systemic, when affecting entire system; local, when limited to one region; functional, when no changes in tissues are discoverable after death; zymotic, when due to presence of specific micro-organisms; malarial, miasmatic or paludal when caused by specific infection of malaria. Many other divisions are made which will be described under their adjective appellations. List of diseases known or believed to be due to infection with specific micro-organisms is being added to constantly, and it is probable that nearly all, not manifestly caused by accident, exposure, or some clearly evident causes, will be included in it.

Disease Germs. Bacteria that normally breed in living organisms, and usually produce the symptoms characteristic of the special disease. The most general result is a rise in temperature called fever; this is probably the direct effect of poisons excreted by the bacteria (as a result of their own proper nutrition) upon the nerve-cells that regulate heat production The fever is the effort of the organism to get rid of the poison.

Disease of Language. Popular corruption of words, by which, according to Max Muller's theory of myths, literal descriptions of natural processes were misunderstood and thought to narrate personal, but supernatural doings.

Disepalous. Calyx composed of two sepals, as in Bloodroot.

Disfranchisement. Expulsion of a member from a corporation, or withdrawal of a political privilege, as the right to vote.

Dish-a-loof. English rural pastime played by boys. One

lays his hand on a table, another places his upon it, and so on; the first then places his on top, followed by the others. The one who stands out longest wins the game.

Dishonor. Failure to accept a bill of exchange, or to pay negotiable paper, upon due presentment.

Disilicic Acids. Regarded as derived from one or more molecules of the ordinary form, H_2SiO_3, by the loss of one or more molecules of water; *e.g.*, $H_2Si_2O_5$, $H_6Si_2O_7$.

Disinfectants. Agents which destroy the micro-organisms (or their spores) of contagious and infectious diseases. Those most commonly employed are heat, carbolic acid, sulphur dioxide, corrosive sublimate, chloride of lime, iron sulphate (green vitriol), quicklime, mineral acids, and zinc chloride. Clothing, bedding, and similar bulky objects are best disinfected by a temperature of 212° F. maintained for several hours; apartments and their contents by sulphur dioxide, generated by burning sulphur; sheets, towels, and articles of cotton or linen by soaking in a solution of corrosive sublimate or zinc chloride and subsequent boiling; fæces, urine, and expectoration by corrosive sublimate, carbolic acid, iron sulphate, or chloride of lime; and privy vaults by chloride of lime, iron sulphate, quicklime, or corrosive sublimate. Suspected waters may be rendered harmless by boiling, and in the case of cholera by addition of small amounts of a mineral acid. Disinfection of wounds is usually performed with carbolic acid or corrosive sublimate.

Disintegration. In Geology, the wearing away of a rock, reducing it to gravel, sand or soil, due to atmospheric agencies.

Disinterested Action. Action not accompanied by any consideration or regard for a foreseen balance of pleasure to ourselves.

Disk. Portion of the receptacle of a flower between the insertion of stamens and pistils; also central portion of the anthodium in the *Compositæ;* also bordered pits in the wood-cells of certain plants, notably the *Coniferæ.*

Disk Engine. One in which a number of pistons and cylinders are used, their axes being parallel to the revolving shaft, and arranged around it symmetrically. The pistons are single acting and bear against an inclined circular plate, which is constrained to oscillate around a spherical joint at its center. A pin perpendicular to the face of this plate or disk at its center can thus be made to move in the surface of a cone, as the disk rocks by the pressures on its back coming successively from the pistons, and the end of the pin fits into the eye of a crank which thus rotates the shaft. The engine reverses by such a shifting of the eccentric disk, which admits and exhausts steam from the pistons, as to cause the succession of admission of steam to the cylinders to reverse. It is convenient for launches and cranes.

Disk Pile. Hollow iron cylinder having a disk-like flange at its lower end. It is used to form foundations in sandy soils, being generally sunk by the help of the water jet.

Dislocations. Displacement of bones from their normal positions as regards those with which they articulate.

Dislodgment. Driving the enemy from a position, either by assault or by effective fire.

Dismal Swamp. A morass s. of Norfolk, Va., ab. 35 m. long, lying partly in Va. and partly in N. C. Its extent has been reduced by drainage; the canal between Chesapeake Bay and Albemarle Sound passes through it. Lake Drummond, near the center, is ab. 6 m. sq.

Disobedience of Orders. All orders and instructions relating to military operations, or affecting the conduct and discipline of the U. S. Army, given by the Pres. and Sec. of War, are promulgated through the General commanding the army. The 21st Article of War provides that "any officer or soldier who disobeys any lawful command of his superior officer shall suffer death or such other punishment as a Court Martial may direct.

Disodium Phosphate (Secondary Phosphate). $Na_2HPO_4.+12H_2O$. Made by treating phosphoric acid with caustic soda, soluble in water with a slightly alkaline reaction.

Disorderly. Habitual disturbance of the peace, comfort, or decency of a neighborhood; applied to conduct, houses, and persons; generally defined by statute.

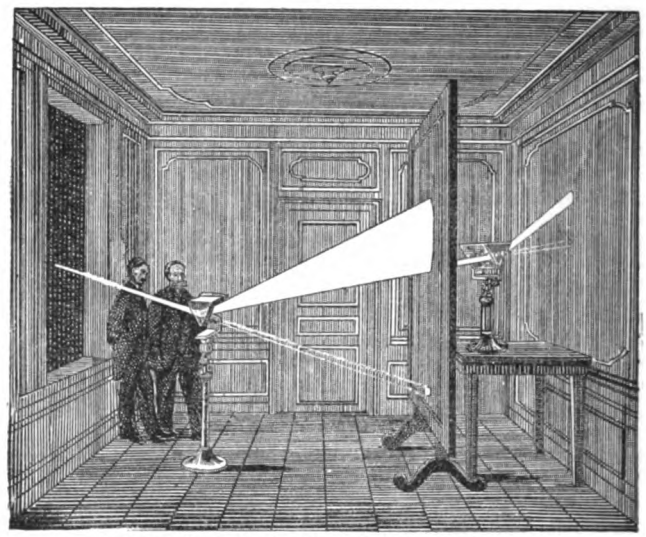
Dispatch. Letter sent by the commander of an army to a superior authority, or by subordinate commanders to a superior officer, containing an account of military operations; usually borne by an officer of judgment and reliability, to whom every facility is afforded.

Dispensary. Institution to supply the poor with medical advice and help.

Dispensation. Exemption by papal or episcopal authority from some rule or law; first granted by the pope 1200.

Dispensatory. Book describing drugs, their preparation and use. That of Drs. Wood and Bache, 1833, has since been greatly enlarged and is in general use.

Dispersion. Process of separating compound light into its constituents; first performed by Newton, who produced



Dispersion.—Solar Spectrum by Newton's Method.

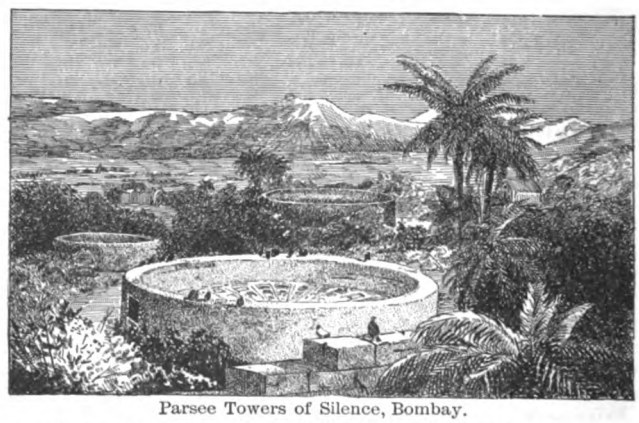
the spectrum of white light by passing a beam of it through a glass prism.

Dispersive Power. Property of a transparent medium, measured not by the absolute dispersion, which in general depends on the angle of refraction, but by the ratio of the dispersion to the total deviation. It can be shown that the dispersive power is equal to $\frac{u_2 - u_1}{u_1 - 1}$, in which u_1 and u_2 are the refractive indices of the extreme red and violet rays.

Displacement Currents. Rate of change of an electric displacement produced in a dielectric, the effect of which in surrounding space is the same as if there had been a conductive instead of an inductive transfer of electricity. While these currents last, they establish magnetic fields, as convexion and conductive currents do.

Displayed. In Heraldry, having the wings expanded, but this applies to birds of prey only; those of all other birds are said to be Disclosed.

Disposal of the Dead. Those ancient nations who worshiped the elements shrank from polluting them with the corruption of the dead and therefore provided living sepulchers. Thus the Parthians, Medes, Caspians, and Iberians exposed their dead to wild beasts, as the Wanyamwesi and other sav-

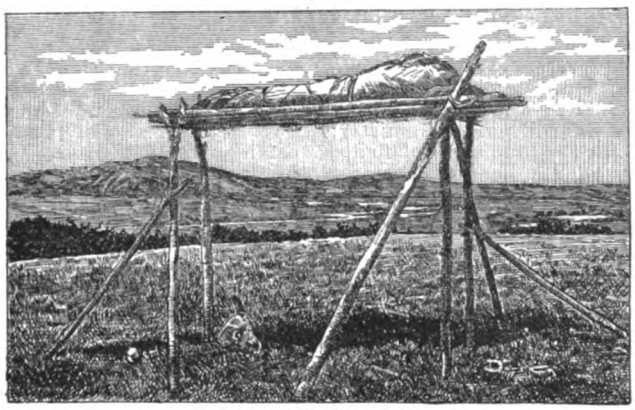


Parsee Towers of Silence, Bombay.

ages do to the present day. The Bactrians, Hircanians, and Magi trained dogs for this special purpose and the Kamtchatdales still do so. The Parsees, who expose their dead to vultures in "Towers of Silence" open to the sky, recall this custom of their Magian ancestors by heading their funeral procession with a dog. The Tartars sometimes devoured their dead, as also did the Massageties, Padæans, Derbices, and Effenders, who strangled the aged and mixed their flesh with mutton. According to Horace and Tertullian the ancient Britons and Irish also disposed of their dead in this way and the African Fans and some S. American tribes do the same.

Water-burial was common to the Ichthyophagi, Lotophagians and the Itzas of Guatemala. Guinea tribes also cast their dead into the sea.

The general practice of antiquity was burial in cairns, caves, mounds, tombs, or simple graves. This was largely supplanted by CREMATION (q.v.) either for sanitary reasons, or as a sacrificial rite, as among the later Greeks and Romans. Religious belief demanding the preservation of the body led to various mummifying processes with subsequent entombment. The Colchians, Tartars, Scythians, W. Indians, Sioux, and Blackfeet suspended their dead in trees, the bodies being partially mummified in the dry winds. Other tribes deposit their dead



Dakota Scaffold-Burial.

on scaffolds with the same purpose. Some Australians make a fire below and smoke-dry the corpse; the old Virginians did the same, and the saltpeter caves of Kentucky also served as a mummifying agent. Scaffold-burial is found among the Cheyennes, Sioux, Chippewas, Gros Ventres, and Mandans, and was sometimes practiced by the Choctaws, Natchez and Iroquois.

The Seminoles and African Obongos sealed up their dead in hollow trees, and the ancient Danes used hollow logs for coffins. On the n.w. coast of N. America the body is placed in a canoe which is elevated on posts, swung from trees, or simply placed on the ground.

Burial in or beneath houses, lodges, cabins, or wigwams, is common to the Bari, Latookas, Kaffirs, and Bechuanas, of Africa, and the Navajoes, Muskogulgees, Eskimos, Blackfeet, and Cheyennes. The Sacs, Foxes, and Pottawatomies build grave-pens.

Mound-burial is universal. In both the Old and New World tumuli, barrows, and mounds afford the surest materials for recovering lost history. See BARROW, CATACOMBS, CEMETERY.

Disposition. Character, looked upon as consisting of certain moral elements, and having a tendency toward certain good or bad actions.—In Law, transfer of property.—In Architecture, arrangement of a plan.

Disraeli, BENJAMIN, LL.D., D.C.L., EARL OF BEACONSFIELD, 1804–1881. English novelist and statesman; son of ISAAC; M. P. 1837; Chancellor of the Exchequer 1852, 1858–59, 1866–68; Premier 1868 and 1874–80; ennobled 1877. Starting as a Radical, he became the strongest leader of the Tories and the leading figure in the Berlin Congress, 1878; his foreign policy, like his whole career, was striking and sensational. His novels display the man and deal largely with public life. *Vivian Grey*, 1826; *Young Duke*, 1831; *Contarini Fleming*, 1833; *Alroy*, 1833; *Henrietta Temple*, 1836; *Venetia*, 1837; *Coningsby*, 1844; *Tancred*, 1847; *Lothair*, 1870; *Endymion*, 1880.

Disraeli, ISAAC, D.C.L., 1766–1848. English author, descended from Spanish and Italian Jews. *Curiosities of Literature*, 1791–1817; *Calamities and Quarrels of Authors*, 1812–14; *Amenities of Literature*, 1841.

Disrespect. The Articles of War provide for the punishment of any officer who uses contemptuous or disrespectful words against the Pres., Vice-Pres., Congress, or the chief magistrate or legislature of any State in which he is quartered; as also for behavior disrespectful to his commanding officer.

Dissection Wounds. Dangerous on account of the introduction into them of decaying animal matters. In severe cases blood-poisoning results; in milder, inflammation of the wounded part occurs with enlargement of glands. Loss of fingers, etc., or even death sometimes occur, the latter very rarely.

Disseisin. Wrongful ouster from possession of the rightful freeholder. The modern term is adverse possession.

Dissen, GEORG LUDOLPH, 1784–1837. Prof. Göttingen from 1813; ed. of sundry classics, and propounder of a theory of poetic style.

Dissenters. Nonconformists; English Protestants not Anglicans, members of numerous sects, formerly under legal disabilities.

Dissepiments. Transverse, incomplete partitions which grow from the septa of many corals.

Dissimulation. Vice of concealing some important part of one's feelings or thoughts for the purpose of deceiving another.

Dissipation. Action by which a body charged with electricity gradually loses its charge and at last becomes entirely neutral.

Dissociation. Decomposition of a chemical compound, due to the action of heat or pressure.

Dissonance. Combinations of sound which are unsatisfying to the ear and produce a craving for resolution into a consonance. Mathematically expressed, they are characterized by ratios composed of large numbers. As the human ear has become more and more educated and better able to analyze complex sounds, many intervals that were formerly dissonant have ceased to be so, and have even become consonant.

Disspondyle. See SHARKS.

Distaff. Staff from which the flax is drawn off in spinning. Its use is very ancient; the Fates in Greek art are always represented distaff in hand spinning the thread of human life.

Distal. That part of an appendage furthest from the body. Applied in an analogous way to other relations.

Distearine. See STEARINE.

Distemper. Method of painting in which the pigments are mixed with size. The execution is on a dry ground, as distinct from fresco on fresh or wet plaster.

Distemper. In dogs, a contagious disease characterized by fever, running from eyes and nose, loss of appetite and strength, disordered digestion, and in severe cases paralysis, especially of hind-quarters. Few escape it, and when neglected is very fatal. One attack is rarely followed by another. Best treated by keeping bowels open, restriction of diet to bread and the like, quinine, and nux vomica. Animal should be kept in dry, warm and clean place and well provided with pure water.

Disthene. Al_2SiO_5. Cyanite; so called in allusion to differences of hardness on different crystalline faces.

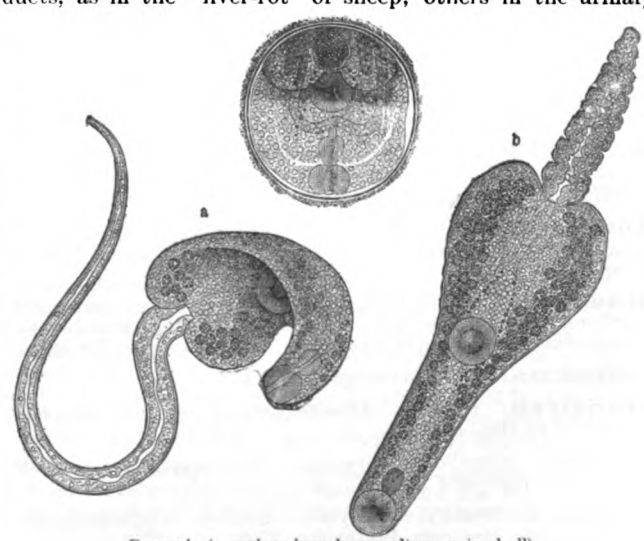
Distich. Two lines, usually hexameter and pentameter; used by the ancients for maxims and epigrams.

Distichous. Two-ranked, as the arrangement of the alternate leaves in the Grasses, Elms and numerous other plants.—In Ornithology, long tail with feathers on each side.

Distillation. Process by which a volatile liquid may be separated from non-volatile substances held in solution, or by which two liquids of different volatilities may be separated. The operation consists first, of vaporization, and, second, of condensation. The apparatus employed is called a Still with Condenser.

Distomea. Trematode worms with one (*Monostomidæ*) or two suckers (*Distomidæ*). They have no hooks. The larvæ and asexual generations live in Mollusks principally, while the adult or sexual animal lives in the intestines of vertebrates. One sucker surrounds the mouth; and a second, if present, is ventral. See DISTOMUM.

Distomum. Fluke of many species. Some live in the bile ducts, as in the "liver-rot" of sheep; others in the urinary



Cercaria (a, swimming; b, crawling; c, in shell).

passages or intestines. See TREMATODA. The Liver Fluke is ovoid in shape and may attain an inch in length. It has two

suckers, and the mouth opens into a branched intestine filled with bile. The animal is hermaphrodite and gives rise to numerous eggs that pass out of a pore between the suckers. Each egg is ab. $\frac{1}{150}$ of an inch long and is expelled with the fæces. If it reaches water it develops into a ciliated embryo, which seeks a snail, bores into its body and becomes encysted and transformed into a sporocyst, in which embryos known as *Rediæ* are produced. Each *Redia* now bores into the snail's liver and grows to ab. $\frac{1}{20}$ of an inch in length. New *Rediæ* may now be produced within this, and ultimately tadpole-shaped young, known as *Cercariæ* are produced by the *Rediæ*. The Cercaria next works itself out of the snail into the water, and after swimming for a time, makes its way to a blade of grass, where it becomes encysted, or into some other host liable to be eaten by a sheep. When so eaten, the cyst dissolves and sets the Cercaria free, which now makes its way to the bile ducts and grows into a Fluke.

Distortion. Change of shape in a body affected by stress.

Distress. Method of redressing injuries by self-help; taking personal property as a pledge of performance on the part of the wrong-doer; generally regulated by statute now.

Distributing Reservoirs. Basins from which water is directly distributed to consumers, as distinguished from collecting or storage reservoirs. They are often used in order to give the water a better opportunity to purify itself by means of sedimentation or aëration.

Distribution. In Economics, division of the results of production among the different persons or factors concerned; return of wages, interest, rent, and profit to those who furnish labor, capital, land, and business management respectively.

Distribution OF ANIMALS OR PLANTS. This may be BATHYMETRIC or GEOGRAPHICAL (q.v.).

Distributive. An operation is distributive as to another when it may be performed upon the result of the other or upon its elements separately and these results combined, without affecting the final result; *e.g.*, $(2x3.)^3 = 2^3x3^3$.

District. Geographical or political division, as Congressional and Judicial Districts in U. S.—In the M. E. Ch., territory under the charge of a presiding elder.

District-Attorney. Law officer of government within a district.

Distyle. In Classic Architecture, having two columns in front.

Disulphuric, or PYROSULPHURIC, ACID. $H_2S_2O_7$. Nordhausen sulphuric acid; a thick, fuming liquid; in its purest form yielding crystals which melt at 35°; made by distilling ferric sulphate.

Ditch. Artificial channel to convey water for mining uses, especially in hydraulic mining. Some of the mining ditches in Cal. are many miles in length.

Ditch Grass. *Ruppia maritima.* Common and insignificant plant of the Pondweed family, growing in masses in salt marsh ditches in Europe and America.

Dithecous. Having two cells.

Dithionic Acid. $H_2S_2O_6$. Unstable; the free acid breaks down into sulphuric acid and sulphur dioxide. First member of a series; the others are: trithionic acid, $H_2S_3O_6$; tetrathionic, $H_2S_4O_6$; and pentathionic, $H_2S_5O_6$. These compounds are all unstable.

Dithyramb. Vehement and emotional form of Greek lyric poetry, tending toward bombast; tragedy was developed from it. Few original specimens survive.

Ditmarschen. W. Holstein: successively part of Charlemagne's empire, Saxony, Denmark, and Prussia. Area 531 sq. m.

Ditolyls. $CH_3.C_6H_4.C_6H_4.CH_3$. Hydrocarbons, prepared by uniting the residues from two molecules of toluene left by the removal of one atom of hydrogen from each. See TOLIDINE.

Ditremata. See STYLOMMATOPHORA.

Ditriglyph. In Doric Architecture, denotes an intercolumination of the triglyphs.

Dittany. *Cunila origanoides.* Perennial plant of the Mint family, native of the e. U. S.

Ditton, HUMPHREY, 1675–1715. English mathematician. *Fluxions,* 1706; *Synopsis Algebraica,* 1709.

Diu. Island, town, and castle, on the southernmost point of Guzerat, India, in the possession of the Portuguese since 1515. Its trade is of little importance. Area 62 sq. m.; pop. 12,700.

Diuretic. Increasing the flow of urine, or agent having that effect.

Diurnal Inversion OF THE WINDS. Law announced by Espy ab. 1840, and independently by Köppen, in accordance with which wind at some little distance above the earth's surface is strongest during the night and feeblest at midday, whereas the reverse is true at the immediate surface of the earth.

Divan, or DIWAN. Persian word meaning a collection of poems by one author: also a Council of State and, by extension, the hall where it sits, or any state chamber; and in other languages a low canopied couch. The Turkish divan consists of the Grand Vizir, or prime minister; Grand Mufti, head of the church; Seraskier Pasha, war minister; Tyrdji Pasha, commander of the artillery; Capudan Pasha, head of the navy; Reis Effendi, foreign minister; Kiaya Bey, minister of the interior; the ministers of finance, commerce, and police; president of the council, master of the mint, and controller-general of church property.

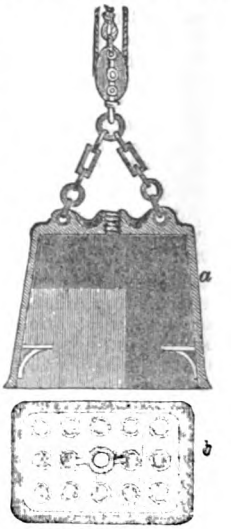
Dividing Engine. Machine for dividing linear distances. There are two kinds; linear engines where, the line to be divided is straight, and circular engines, where the line is an arc of a circle. A linear engine consists of a carefully constructed screw carrying a nut, to which is fastened the cutting or marking tool. The head of the screw is graduated. By turning the screw through a given number of turns and fractions of a turn, and making a mark at each repetition, any given distance may be divided into parts of any given magnitude. A circular engine is similar in principle, but the micrometer screw in this case is a tangent screw.

Divi-Divi. Powerful astringent, used also in tanning, obtained from the pods of *Cæsalpinia coriaria,* a native of tropical and Central America, containing tannic and gallic acids.

Divination. Art of obtaining a knowledge of secret or future things by the aid of dreams or oracles, or by the aid of magical rites and the observation of natural phenomena, such as the flight and cries of birds, the appearance of the clouds and the lightning, and the movements of the stars, called natural divination; practiced by Greeks, Romans and Orientals, forbidden by the Jews. In natural divination the oracle was taken as a direct revelation from a spiritual being, who spoke through the voice of the priest, or of a ghost or ancestor who influenced the medium. The methods of artificial divination, as still practiced by primitive people, and survive from remote antiquity among cultivated nations, are based upon an artificial association of ideas in analogy and symbolism, which is found at the present day in a high degree of elaboration among the Chinese and the aboriginal tribes of America. The implement of magic employed in divination by primitive man almost universally throughout the world was his arrow. The bundle of marked arrows, representative of the entire clan, employed as lots, gave rise to many of the existing forms of sortilege. Also arrows were shaken and auguries made, according to their chance falls (belomancy). This was followed by the substitution of staves for arrows (rhabdomancy) and afterward shells, knuckle-bones and dice for staves (astragalomancy). Divination with arrows and their derivatives appears to have been the traditional and accepted method among the ancient Babylonians, the heathen Arabs, the old Chinese, Tartars, Hindus, and the Scandinavian and Teutonic people, and was universal among the Indians of North and Central and probably of South America.

Divine Right. Theory that the king is God's vicegerent, accountable to Him alone, and that passive obedience is the duty of subjects. Overthrown in w. Europe between 1550 and 1792, it survives in Russia, Turkey, and some Asiatic countries, and to a less extent in Germany. Cherished by sovereigns and their courtiers, it is hopelessly at odds with progress and liberty.

Diving-birds (DIVERS). See ALCIDÆ.



Diving Bell.
a, section showing inside; *b*, top.

Diving Bell. Bell-shaped vessel into which air is forced so that when sunk in water workmen may descend in it, fresh air being continually supplied by an air pump.

Diving Dress. Worn by divers who work under water, the most important part being an air-tight helmet around the head, which is constantly supplied with fresh air through a pipe from a pump on the surface.

Diving Dress.

Divining Rod. Forked twig by aid of which some think that ore deposits, subterranean water, hidden treasure, etc., can be discovered; also called Dowsing Rod.

Divisibility. That general property of matter in virtue of which a portion of it may be divided into two or more parts. There are many reasons for supposing that this process of division cannot be carried out indefinitely, but that finally a particle would be obtained so small that further subdivision would destroy the identity of the substance. Such a particle, called a molecule, may also be divided, but the resulting particles, called atoms, are different in their properties from the matter thus subdivided.

Division. Process, a product and one factor being given, of finding the other factor. The given product is the dividend; the given factor the divisor; the required factor the quotient. Division is exact when the quotient is wholly integral and there is no undivided remainder. In algebra, numerical coefficients are divided as in arithmetic; literal quantities are divided by subtracting the exponent of any quantity in the divisor from the exponent of the same quantity in the dividend. A negative exponent indicates that the quantity affected is a divisor. Like signs of divisor and dividend give a positive quotient, unlike signs a negative quotient. In elementary algebra, division is commutative; *i.e.*, divisor may be made quotient by placing the quotient as divisor. In higher algebra, division becomes non-commutative.

Division. In the ordinary composition of an army for field service, two regiments constitute a Brigade, commanded by a Brigadier-general; two or more brigades a Division, commanded by a Major-general; but in the peace establishment of the U. S. Army neither brigades nor divisions are formed. A military Division in time of peace consists of two or more geographical departments, commanded by one of the senior Major-generals.

Division, Synthetic. Abridged method of division when divisor and dividend are homogeneous polynomials, involving more than two letters. The process is made shorter by the suppression of the literal elements, whose sequence in the quotient is known, and by an arbitrary arrangement of partial results.

Division of Labor. Separation of any process of production into different processes, each performed by a different person; thus, by economy of labor, acquisition, and skill, vastly increasing the total production.

Divorce. Absolute or partial dissolution of the marriage tie, by legislative act or judicial decree. The causes for which and the method by which it may be obtained differ widely. The Mosaic Law allowed the husband an absolute right of divorce. Some later Jewish schools declared adultery or equivalent guilt alone to authorize it for either party. Christ emphatically enforced this stricter principle. The Roman, Greek, and Anglican Churches adhere more or less closely to this rule. The practices of most Protestants, like the laws of many countries and states, vary greatly.

Dix, Dorothea Lynde, ab. 1794–1887. American philanthropist. *Prisons*, 1845.

Dix, John Adams, LL.D., 1798–1879. N. Y. Sec. of State 1833–40; U. S. Senator 1845–49; Sec. Treasury Jan.–Mar. 1861; Major-gen. U. S. Vols. 1861–65; Minister to France 1866–68; Gov. of N. Y. 1873–74.—His son Morgan, D.D., D.C.L., b. 1827, has been rector of Trinity Ch., N. Y., since 1862.

Dixie. Jocose term for the South during the Civil War; from a negro song of older date.

Dixon, William Hepworth, 1821–1879. English author, biographer of Howard, 1850, Penn, 1851, and Bacon, 1860. *London Prisons*, 1850; *New America*, 1867; *Spiritual Wives*, 1868; *Free Russia*, 1870; *Her Majesty's Tower*, 4 v., 1870–71; *Royal Windsor*, 1878–80.

Dizziness. See Vertigo.

Djezzar (Butcher). Nickname of Achmed, 1735–1804. Pasha of Acre, which he held when besieged by Napoleon's troops March 20–May 21, 1799.

Djinn. See Jinn.

Dnieper. Large river of s.w. Russia, flowing s. e. and then s.w. into the Black Sea. Length 1,272 miles, drainage area 193,195 sq. m. It is the ancient Borysthenes, and in size the third river of Europe.

Dniester. River heading in Galicia and flowing s. e. across part of Russia to the Black Sea. Length 682 miles, drainage area 27,553 sq. m.

Doane, George Washington, D.D., LL.D., 1799–1859. Bp. of N. J. 1832. His *Songs by the Way*, 1824, included a few fine hymns.—His son, William Crosswell, D.D., LL.D., b. 1832, became Bp. of Albany 1869.—Another son, George Hobart, b. 1830, has been R. C. Vicar-gen. of Newark since 1873.

Dobell, Sydney, 1824–1874. English poet. *Balder*, 1854.

Döbereiner, Johann Wolfgang, 1780–1849. Prof. Chemistry at Jena from 1810. His "lamp" is a platinum sponge which ignites a jet of hydrogen.

Dobrizhoffer, Martin, 1717–1791. Austrian Jesuit, missionary in Paraguay 1749–67. *Hist. Abipones*, 1784, tr. 1822.

Dobrowsky, Joseph, 1753–1829. Slavonic philologist, author of a Bohemian dictionary, 1802–21, a history of the language and literature, 1792, and other works of authority in this field.

Dobrudja, or Dobrudscha. Province between the Danube and the Black Sea, freed from Turkey and joined to Roumania 1878. Area 6,102 sq. m.; pop. ab. 175,000, of various races.

Dobson, Henry Austin, b. 1840. English poet; biographer of Hogarth, 1879, Bewick, 1884, Steele, 1886, and Goldsmith, 1887. *Vignettes in Rhyme*, 1873; *Proverbs in Porcelain*, 1877; *At the Sign of the Lyre*, 1885.

Dobson, William, 1610–1646. English portrait-painter.

Docetism. Early and widely extended heresy, maintaining Christ's humanity to have been merely phenomenal, not substantial. Its adherents, the Docetæ, were a Gnostic sect.

Dochmius. See Strongylidæ.

Dochmius Duodenalis. Species of trematode worm sometimes found in the intestines of miners, brickmakers, and workers in tunnels. Anæmia is believed to be the cause of it.

Dock. Various species of *Rumex;* genus of the *Polygonaceæ*, of wide geographical distribution. The common weedy species of e. America, introduced from Europe, are unsightly and troublesome weeds in grass and grain crops and about buildings. They are biennials, and may be kept in check by cutting and destroying the plant before the seeds have ripened.

Dock.

Dock. Basin protected by walls or piers, where a vessel may lie to unload, and be secure from sudden currents or tides. Many European harbors require extensive docks; those of London cover an area of 795 acres, and those of Liverpool 364. The docks of most U. S. harbors are temporary wooden structures.

Docket. Abstract of a legal paper or proceeding, duly entered by a public officer; or the record of such abstracts.

Dockmackie. Maple-leaved Arrowwood, *Viburnum acerifolium;* shrub of the Honeysuckle family, native of e. America.

Docoglossa. See Cyclobranchiata.

Doctor. Originally, a teacher in general; in the Middle Ages, an eminent theologian, as Aquinas, Duns Scotus, Hales, Occam, Roger Bacon; in modern times, the holder of a degree, earned or honorary, conferred by an institution of learning. We have doctors of Medicine, M.D.; of Law, LL.D., D.C.L., or U.J.D.; of Divinity, D.D. or S.T.D.; of Philosophy, Ph.D.; of Letters, L.H.D.; of Music, Mus. Doc.; and of Science, D.Sc.

Doctor Busby. Game played with special cards with pictures representing various families, and the first of similar games played with special cards of which "Authors" is a type; invented in 1843.

Doctor of Music. Superior of two degrees conferred by English universities, the inferior being Bachelor, which in regular course must precede the other by five years. That of Mus.

Doc. is conferred by some colleges in the U. S., but only as an honor. In Gt. Britain examinations and theses are required, except when the purpose is to honor distinguished composers, as in the cases of Haydn, Brahms, Dvorák, and others. This title dates from 14th or 15th century,

Doctor of the Church. Title given to certain Fathers of the Greek and Latin Churches. The Greek Fathers were Athanasius, Basil, Gregory Nazianzen, and Chrysostom; and the Latin, Jerome, Augustine, Ambrose, and Gregory the Great. Later this title was conferred by the Popes on various scholars and divines with certain distinguishing epithets; among others Thomas Aquinas (Angelicus), Bonaventura (Seraphicus), Alexander de Hales (Irrefragabilis), Duns Scotus (Subtilis), Roger Bacon (Mirabilis), William Occam (Singularis), Joseph Gerson (Christianissimus), Thomas Bradwardine (Profundus), etc.

Doctors' Commons. Courts and offices of a society of lawyers, organized 1568, and incorporated 1768 as "The College of Doctors of Law exercent in the Ecclesiastical and Admiralty Courts," on s. side of St. Paul's Churchyard, London; called Commons because the doctors of civil law had to dine together four days in each term. The college was dissolved 1857, and the ecclesiastical courts are now open to the whole bar.

Doctrinaire. Political theorist; one who follows abstract ideas with little regard to their practicability; opposed to opportunist. French royalists applied the term ab. 1816 to Guizot and other moderates or constitutional liberals.

Doctrine. That which is taught on any subject, especially in religion. See DOGMA and THEOLOGY.

Document. Paper or parchment bearing words, of possible evidential value; in Law, a written instrument.

Dodd, CHARLES. Pen-name of HUGH TOOTEL, 1672–1743. English R. C. priest. His *Ch. History of England*, 3 v., 1737–42, extends from 1500 to 1688, and aimed to answer that of Bp. Burnet.

Dodd, WILLIAM, D.D., 1729–1777. London divine, highly esteemed as preacher and author; but hanged for forgery.

Doddart. Provincial English name for the game of Hockey or Shinney.

Dodder. Parasitic vines of the genus *Cuscuta*, natural family *Convolvulaceæ*, growing on herbs or shrubs, of wide geographical distribution. *C. epilinum* twines about other plants and lives by sucking their juices. Flax and clover are the cultivated plants most often attacked. The dodder seed is usually sown with the seed of its host; care in this respect is the best precaution.

Cuscuta europæa.

Doddridge, SIR JOHN, 1555–1628. Justice of King's Bench from 1613. *Compleat Parson*, 1602; *Lawyer's Light*, 1629; *Antiquity and Power of Parliaments*, 1656.

Doddridge, PHILIP, D.D., 1702–1751. English Independent, pastor and teacher at Northampton from 1729. *Rise and Progress of Religion in the Soul*, 1745; *Family Expositor*, 6 vols., 1739–56; *Life of Col. Gardiner*, 1747. After Dr. Watts he is the most important hymnist of the old sober school.

Dodecagon. Polygon of twelve sides.

Dodecahedron. Solid bounded by 12 plane faces.

Dodecandria. Linnæan class of plants including those having from 10 to 20 stamens.

Dodecandrous. Flower with 12 stamens.

Dodecastyle. In Classic Architecture, having twelve columns in front.

Döderlein, JOHANN CHRISTOPH, 1746–1792. Prof. at Altdorf 1772 and Jena 1782. *Christian Theology*, 1780.—His son LUDWIG, 1791–1863, prof. at Berne 1815 and Erlangen 1819, edited sundry classics, and pub. 6 vols. of *Latin Synonyms and Etymologies*, 1839.

Dodge, MARY ABIGAIL ("GAIL HAMILTON"), b. ab. 1830. American essayist. *Country Living*, 1862; *Gala Days*, 1863; *Woman's Wrongs*, 1868.

Dodge, MRS. MARY (MAPES), b. 1838. American author; ed. *St. Nicholas* since 1873. *Hans Brinker*, 1865.

Dodgson, CHARLES LUTWIDGE ("LEWIS CARROLL"), b. 1832. English humorist. His mathematical treatises are less known than *Alice in Wonderland*, 1865, and *Through the Looking-Glass*, 1871. *Sylvie and Bruno*, 1890–94.

Dodington, GEORGE BUBB, BARON MELCOMBE, 1691–1762. M.P. 1715–54. *Diary*, 1784.

Dodo. Pigeon-like bird found living upon the Island of Mauritius till ab. 1681, when it was exterminated, its wings being short and incapable of lifting its large body (size of a swan) in flight. The tail bore a tuft of plumes. The legs were

Dodo (*Didus ineptus*).

short, stout, and four-toed. The beak had its upper mandible curved at the apex. In this and neighboring islands other and smaller birds with rudimentary wings have been exterminated, as *Pezophaps*, *Aphanapteryx*. A bird of related character, but not larger than a partridge (*Didunculus*), is still living in the Navigator Isles.

Dodoens, REMBERT, 1517–1585. Dutch botanist. *De pugum historia*, 1552; *Cruydeboeck*, 1563; *Stirpium historiæ pemptades sex*, 1583.

Dodona. Oldest oracle of Greece, in Epirus; dedicated to Zeus. Responses were given by the rustling of oaks or beeches.

Dods, MARCUS, D.D., b. 1834. Scottish divine and author; prof. New Col., Edinburgh, 1889. *Parables*, 1883–86.

Dodsley, ROBERT, 1703–1764. London bookseller and dramatist. *Collection of Old Plays*, 12 vols., 1744.

Dodwell, EDWARD, 1767–1832. English traveler. *Greece*, 1801; *Pelasgic Remains*, 1834.

Dodwell, HENRY, 1641–1711. Irish divine, prof. at Oxford 1688–91; non-juror; noted for piety, learning, and oddity of opinions.

Doe, JOHN. Fictitious name, formerly much used, with that of Richard Roe, as plaintiff and defendant in ejectment.

Dog. See CYNOIDEA and DOGS.

Dogbane. Species of the genus *Apocynum*, milky-juiced plants of the natural family *Apocynaceæ*, natives of N. America; known also as Indian Hemp.

Dog-days. July 3–Aug. 11, before and after rising of the dog-star, Sirius, anciently supposed to cause summer heat.

Doge. Highest magistrate of Venice; dating from 697. His powers were restricted in 14th century when the Council of Ten was instituted. The last Doge was chosen 1788, and fell 1797. A similar office in Genoa dates 1339–1797, and in Amalfi 897–1350.

Dog Fo. Chinese and Japanese representations of the Buddhistic lion, which is constantly used in e. Asia as a symbolic ornament, apparently derived from the family name of the saint: Sakya or "Lion."

Dogfish. Various sharks and also the ganoid fish, *Amia*, also called Mudfish. The very common shark, length one to three feet, abundant off our N. Atlantic coasts, is *Squalus acanthias*, gray above and white on the belly. Great numbers are caught for their livers, which furnish oil, and their bodies, which may be used for fuel, poultry food, or best as stock for fertilizers.

Doggerbank. Sandbank 320 m. long ab. 50 m. wide between England and Denmark in the North Sea. It is the chief seat of the English and Dutch cod-fisheries. The Dutch boat used here is called a Dogger.

Dogma. Originally an opinion, later a fixed doctrine, propounded by Ch. authority.

Dogmatics. Science of doctrines; usually divided into

Theology proper, Anthropology, Christology, Soteriology, Ecclesiology, and Eschatology, treating respectively of God, Man, the person of Christ, the means of salvation, the Church, and the last things. Ethics is sometimes added.

Dogmatism. Method of philosophy which dispenses with doubt and criticism, and asserts certain presumably fundamental principles, which are really open to dispute. It is largely deductive in its procedure.

Dogs. Domesticated in prehistoric times. Now 189 varieties, supposed to have descended from wild forms of which the JACKAL (or Coyote), the WOLF, GUARA, DINGO, and HUNTING DOG of S. Africa are examples (q.v.). Wild forms resemble the domestic forms of same locality and are fertile with them; 63 days gestation in all. Wild forms howl and rarely bark, the hairless species of Mexico and S. America do not bark. Dogs do not sweat. Normally there are sectorial teeth, 6 in upper jaw, and 7 in lower, but these much reduced in the Japanese pug, which lacks also the incisors. Hairless dog of Egypt had only one molar. When dogs are eaten, they are fed a vegetable diet. Hair has distinct characteristics in each breed. The following races are supposed descended from distinct species, modified by crossing: ESKIMO, GREYHOUND, HOUND, JAPANESE, MASTIFF, NEWFOUNDLAND, SHEPHERD, SPANIEL, TERRIER (q.v.).

Dog Star. See SIRIUS.

Dog-tooth. A molding, especially common in Norman architecture, composed of a succession of small pyramidal projections.

Dog-tooth Spar. Crystallized variety of calcite, occurring in scalenohedrons, or acute rhombohedrons, whose length is about three or four times their thickness.

Dog-tooth Violet. *Erythronium dens-canis.* Spring flower of n. Europe and Asia. It grows ab. 6 in. high, and the foliage is blotched with white and purple-brown. An American species, *E. americanum*, is also called Yellow Adder's-tongue.

Dog-Watch. On shipboard 4–6 and 6–8 P.M.

Dogwood. *Cornus florida.* Small tree of the natural

European Dogwood (*Cornus sanguinea*): *a*, flower.

family *Cornaceæ*, native of e. N. America. The European Dogwood, *C. sanguinea*, was formerly used for making arrows.

Dogwood, POISON. See SUMACH, POISON.

Dohrandt, C. F., 1847–1878. Director physical observatory at Tiflis; author of extensive researches in Anemometry and Magnetism.

Dohrn, ANTON, b. 1840. Prussian embryologist, founder of the zoölogical station at Naples, 1870.

Doit. Dutch copper coin, in use ab. 1550–1800, and later in Java.

Dolabella, PUBLIUS CORNELIUS, 70–43 B.C. Son-in-law of Cicero; tribune 48, consul 44, gov. of Syria 43; outlawed for tyranny and greed.

Dolabriform. Ax-shaped leaves and petals of certain plants.

Dolci, CARLO, 1616–1686. Florentine painter of the Decadence, of a somewhat affected and sentimental tendency. He has pictures in the Pitti Gallery at Florence, in the Corsini Gallery at Rome, and elsewhere.

Dolcino, d. 1307. Italian reformer or schismatic, who ab. 1300 succeeded Segarelli as leader of the Apostolic Brethren or Dulcinists. He was burned.

Doldrums. Belt of calm and sultry weather that attends the meteorological equator. It is but 6 to 10 degrees broad, and sways n. and s. annually with the seasons: in the Atlantic it is at 10° N. in July and Aug.; but only 5° in Dec. and Jan.; in the Pacific it nearly coincides with the geographic equator. The term is applied by Abercromby also to any belt of calms between two opposing systems of winds.

Dole, NATHAN HASKELL, b. 1852. American author, translator of Tolstoi and Valdés. *Masters of Russian Literature*, 1886; *Not Angels Quite*, 1893.

Dolerite. See BASALT.

Dolet, ETIENNE, 1509–1546. French scholar, who printed his own works on theology and the classics; hanged and burned in Paris for heresy. His statue was erected 1889 on the spot.

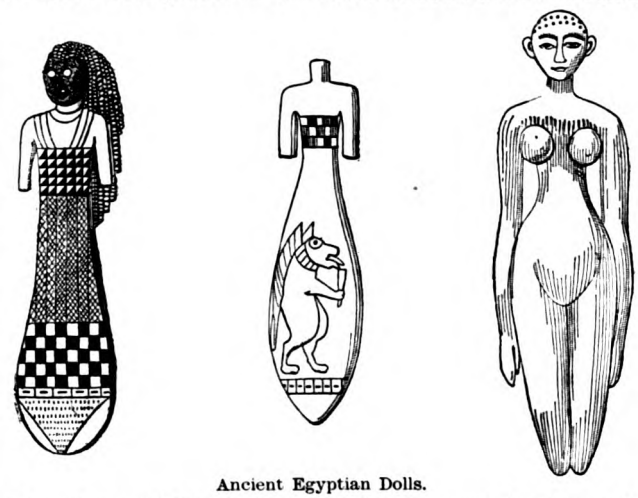
Dolgoruki, PETER, PRINCE, 1807–1868. Russian political and historical writer, banished 1861.

Dolgoruky, KATHARINA, PRINCESS. Morganatic wife, 1880, of Alexander II., whose life she pub. 1882.

Dolichocephalic. Head whose cranial length bears a ratio of 9 : 7 to its breadth. Such heads are said to be "long," and is the characteristic of the Celtic and Anglo-German skull. See MAN and CRANIOMETRY.

Doliolum. See CYCLOMYARIA.

Doll. As children's toys, dolls are extremely ancient, being found in Egyptian tombs carved in wood. The Greeks also had them in terra-cotta, ivory and wood (with jointed limbs) and later they were modeled in wax. If the child died young the dolls were placed in the tomb dedicated to the infernal



Ancient Egyptian Dolls.

gods. In the Middle Ages wax dolls were used in the machinations of witchcraft, and later they were sent from Paris fashionably clothed as models of the newest modes. At Venice one was exhibited every year as a type of the costume officially recommended.

Dollar. Silver coin first struck in Bohemia in the 15th century. Dutch and Spanish silver pieces also received this name in English, and in colonial times Spanish-American dollars were widely circulated in the States. The Congress of 1792 fixed the dollar as the monetary unit of the U. S. and named its multiples and fractions. It weighed 416 grains, 371¼ grains pure silver. The Act of 1837 fixed the weight at 412½ grains of 90 per cent pure silver, the same as before. The half dollar weighs 192.9 grains, the subsidiary coins being the fractions of this and of 90 per cent silver. The trade dollar weighed 420 grains. By the Act of 1849 gold dollars, 25.8 grains $\frac{9}{10}$ fine, were coined, and declared the unit of value 1873.

Döllinger, JOHANN JOSEPH IGNAZ, D.D., LL.D., 1799–1890. Prof. Univ. Munich 1826, and its rector 1873. From 1859 he held a critical position toward the papacy, and in 1870 he frankly reviewed the Vatican Council's decrees, opposing especially that of papal infallibility. His excommunication 1871 made him leader of the Old Catholics, but he disapproved any separate organization. Of his many books *History of the Church*, 1840–42; *Gentile and Jew*, 1862; *The Church and the Churches*, 1862; *First Age of Christianity*, 1866; *Janus*, 1869; *Reunion of the Churches*, 1872; *Prophecies*, 1873, and *Hippolytus*, 1876, have been tr. into English.

Dollond, JOHN, F.R.S., 1706–1761. English inventor of the achromatic lens, 1757; noted, with his son PETER, 1730–1820, as a maker of telescopes.

Dolly-tub. Used in ore-dressing, in which the ore is stirred during the process by a revolving wheel or paddle.

Dolly Varden. *Salvelinus malma.* Trout of n. Pacific coast, called also bull-trout and golet.

Dolmens. Large stones standing erect, and covered by one or more huge flat stones, so arranged as to inclose a chamber or gallery; found in England and France. See CROMLECHS.

Dolomieu, DEODAT GUY SYLVAIN TANCREDE DE GRATET DE, 1750–1801. Prof. Paris School of Mines 1796. He accompanied Napoleon in the Egyptian campaign of 1798, but was taken prisoner and held at Naples, 1799–1801. His earlier writings related to volcanic phenomena, his later to general mineralogy.

Dolomite. 1. $(Ca,Mg)CO_3$. Crystallizable mineral, resembling calcite, but containing magnesium carbonate and calcium carbonate in nearly equal parts. 2. Rock consisting essentially of this mineral; sometimes called magnesium limestone. A large part of the limestone of the country is dolomitic.

Dolph, JOHN HENRY, b. 1835. American genre and animal painter, best known from his cat pictures.

Dolphin (MAMMALIA). See DELPHINIDÆ (*cetacea*).

Dolphin (PISCES). Acanthopterygian fish, noted for its brilliant colors, changing in death, and its short, wedge-shaped head with the front edge perpendicular; found in the Gulf Stream, off Hatteras, etc.; used as food by sailors. The flesh is said sometimes to be poisonous and is tested by cooking a silver piece with it; if this turns black the fish is rejected as dangerous. *Zeus faber*, the Angel-fish, is also sometimes called Dolphin.

Domat, JEAN. 1625–1696. King's Advocate at Clermont, France. *Civil Laws.* 1689.

Dombrowski, JOHN HENRY, 1755–1818. Polish general, in the French service 1796–1814.

Dombrowsky, JAROSLAV, 1826–1871. General of a Polish legion in France 1870, and of the Commune 1871.

Dome. A cupola or spheroidal covering of a building. The word itself was originally used to denote a cathedral, and Dom is so employed in German. The dome as a covering was introduced by the Romans, but always used by them in a depressed form, more like a saucer than a cup or cupola. The most famous of Roman domes is that of the Pantheon. In Byzantine work the dome plays an important part, and especially in the chief monument of the style, St. Sophia at Constantinople. Here, however, as in Roman building, it was depressed, and was designed to be mainly an interior feature. In the revival of classic architecture in Italy, the dome, under Brunelleschi, Alberti, Bramante, Palladio and Michelangelo, became the conspicuous and dominating feature of the exterior as well as of the interior. For interior effect, however, the low Roman dome was preferable to the taller cupola required to crown the exterior, and in many instances, as in the Invalides at Paris and St. Paul's at London the difficulty was met by the construction of a double dome, the inner being of a larger radius than the outer. See BYZANTINE ARCHITECTURE.

Dome-book. Compilation of legal rules and forms by King Alfred.

Domenichino, 1581–1641. Italian painter of the school of Bologna; real name Domenico Zampieri. Among his important works are the *Diana and Nymphs*, Borghese Gallery, Rome; *Last Communion of St. Jerome*, in the Vatican; *St. Cecilia*, in the Louvre; *Evangelist John*, in Cassel. He was a thoroughly conscientious artist, but not of creative genius.

Dome of a Steam Boiler. Cylinder of boiler plate attached on the upper part of a boiler, usually with its axis at right angles to the shell. The object of it is to secure dry steam for the engine cylinders. The rapid boiling of water causes much spattering of water where the steam is disengaged. The large diameter of the dome causes the flow of steam through it to the steam outlet at the top to be relatively slow, and time is given for some entrained water to drop back. The distance of the outlet from the disengagement surface also diminishes the danger of mechanical aspiration of solid water. In marine practice the dome is often annular and is made to surround the base of the smoke-stack, both being common to a number of boilers. Such a dome is called a steam-chimney. A number of boilers in a nest or battery often deliver into one transverse steam drum, which replaces the individual domes. The objections to the ordinary dome are that the cutting away of the shell under it weakens the boiler, and the unequal stretching at the joint of dome and shell makes the seam leak, which leads to corrosion.

Domesday Book. Official record of the survey of most of the lands of England, made 1080–86, intended as a register to determine the right in the tenure of estates; pub. 1873–76. Camden calls it "the tax-book of King William."

Domestic System of Industry. Method in which the raw material is given out by the employer to the workman to be manufactured in his own house at a stipulated rate of pay by the piece. It was most usual after the downfall of the guild system and before the entrance of the modern factory system.

Domeykite. Cu_3As. Copper arsenide, found in Chili and in the Lake Superior copper region.

Domeyko, IGNACIO, 1802–1889. Polish mineralogist and mining engineer, in Chili from 1838. Prof. 1839. *Araucania y Sus Habitantes*, 1845.

Domicile. Place where one resides with no present intention of removal.

Dominic, ST. See DOMINICANS.

Dominica. One of the Lesser Antilles or Leeward Is., n. of Martinique; discovered 1493; settled by the French ab. 1610; held by Gt. Britain 1759–78, 1783–1802, and since 1814. Area 291 sq. m.; pop. ab. 30,000, mostly negroes.

Dominical Letter. That indicating Sunday in the almanac through the year; A, B, C, D, E, F, or G, according to its position among the first seven days of the year.

Dominican Republic. Major part of the island of St. Domingo, Haiti lying to the west of it; organized 1844; ceded to Spain 1861, but resumed its autonomy 1865. Area, 18,045 sq. m.; pop. ab. 600,000.

Dominicans. Order of Mendicant Friars, founded by St. Dominic 1215; famous as theologians, inclining to austere views of human depravity, and terrible as inquisitors. Dominic, a Spaniard, 1170–1221, made its beginnings in his effort to convert the Albigenses, against whom the sword proved more efficacious than the Word. The order has included many eminent men, and has furnished 4 popes, 60 cardinals, and over 800 bishops. It still has houses in all parts of the world.

Dominicans: costume indoors and abroad.

Dominion of Canada. See CANADA.

Dominis, MARCO ANTONIO DE, 1566–1624. Dalmatian Jesuit, Bp. of Segni 1596, Abp. of Spalatro 1598. He went to England 1616, was made Dean of Windsor 1617, and wrote against Rome, but returned to Italy 1622 to die in prison and have his corpse burned as that of a heretic. He was eminent as a scholar, theologian and mathematician, but vain, passionate, fickle, and unwisely ambitious. *De Republicâ Ecclesiasticâ*, 1617.

Domino. Originally a warm outer garment worn by ecclesiastics; the name is now confined to a wide-sleeved masquerade cloak.

Dominoes. A popular game in China, Korea, Siam and Burmah, as well as European countries. The Oriental pieces differ from the European in the absence of the "blanks." Our own game was derived from the East, probably China, where in A.D. 1120 the present form of the Chinese game was fixed by imperial decree. It consists of 21 distinct pieces formed by the permutations of two dice, 11 of which are duplicates, making 32 dominoes in a complete set. It is played by two or four persons, in which are used small flat rectangular pieces of wood or bone upon whose upper surface are marked spots from blank to twelve in number. The domino is divided by a line in the center into two halves, and each contains a certain number of spots; that is, it may be a double blank or a one and blank and so on up to double six. The game is dependent upon matching the ends of these dominoes as they are laid down.

Domitian, TITUS FLAVIUS, 51–96. Roman Emperor from 81; younger son of Vespasian. He ruled well for a time, but was soured by defeats in the north ab. 87, became an atrocious tyrant, and filled Rome with blood and mourning.

Dom Pedro. The game of Pedro Sancho, when a joker or blank card called Dom is used in the game. See PEDRO SANCHO.

Don. River which heads in the plains of central Russia, and flows s., s. e., and s.w. into the Sea of Azov, through a delta. Length 1,185 miles, drainage area 170,638 sq. m.

Donaldson, JAMES, b. 1831. Prof. Edinburgh 1881, pres Univ. St. Andrews 1890; ed. *Ante-Nicene Christian Library*, 1867–72. His *Hist. Christian Literature and Doctrine*, 1864–66, extends to 325.

Donaldson, JOHN WILLIAM, D.D., 1811–1861. English philologist and critic. His *New Cratylus*, 1839, and *Varronianus*, 1844, were upon classical philology; *Jashar*, 1854, was an attempt to reconstruct the Book of Jashar from old songs and historical statements.

Donatello (DONATO DI BETTI BARDI), 1386–1466. Florentine sculptor; one of the three or four earliest and greatest of the Renaissance. His tendency was to positive realism and strong characterization. His greatest work is the first modern equestrian statue, that of the mercenary captain Gattamelata in Padua. His *St. George* on Or San Michele, *David* in the Uffizi, and *Annunciation* relief in Santa Croce, all in Florence, are other well-known works.

Donati, GIAMBATTISTA, 1826–1873. Director of the observatory at Florence 1864; discoverer of the comet of 1858, named from him.

Donation. Free gift; transfer of property without payment.

Donation of Constantine. Spurious document, first heard of 778, purporting to acknowledge the Pope's primacy and grant to Sylvester (314–335) imperial rights in the West; long supposed genuine and urged in behalf of papal claims.

Donatists. North African schismatics, laying intense stress on pure discipline, and denying Catholic baptism. They originated ab. 311 with Donatus, a Numidian bishop, were led by another Donatus Bp. 315–348, and became numerous, violent, and ultimately destructive.

Donatus, ÆLIUS, ab. 350. Roman grammarian; teacher of St. Jerome; noted for his commentaries on Terence and Virgil. His *Ars Grammatica* was very popular throughout the Middle Ages and in the early days of printing.

Donauwörth. Town of Bavaria, on the Danube; once a free city; scene of Marlborough's victory over the Bavarians, July 2, 1704, and of that of the French under Soult over the Austrians under Mack, Oct. 6, 1805. Pop., 1890, 3,733.

Doncaster. English town in Yorkshire, site of a Roman settlement and seat of the kings of Northumbria. It has manufactures of iron and linen and is famous for its horse races, the St. Leger stakes having been founded here 1776. Pop. 25,936.

Donelson, ANDREW JACKSON, LL.D., 1800–1871. Nephew and sec. of Pres. Jackson; U. S. Minister to Prussia 1846–49.

Donetz. Right-hand branch of the Don, in s. Russia. Length 378 m.; drainage area 38,481 sq. m.

Dongola. Province of Nubia. The chief town of the same name on the Nile is a great slave emporium. Pop. 10,000.

Doni, ANTONIO FRANCESCO, 1503–1574. Italian writer of *Novelle* and commentaries.

Donizetti, GAETANO, 1797–1848. Italian opera composer, the most successful of his time after Rossini and Bellini. His first opera appeared 1818, but his reputation was confined to Italy till his *Anna Bolena*, 1830. He composed 65 operas, 63 of

Gaetano Donizetti.

which were performed. Those best known now are: *Elisir d'Amore*, 1832; *Lucrezia Borgia*, 1833; his masterpiece, *Lucia di Lammermoor*, 1835; *La Favorite*, 1840; *La Fille du régiment*, 1840; and *Don Pasquale*, 1843. Those of 1840 were written for Paris.

Donjon. In mediæval architecture, the tower of a castle. The lower part was commonly used as a place of confinement, whence dungeon.

Don Juan. Hero of old Spanish legends; of Molière's comedy, 1665; of Mozart's opera, 1787; and of Byron's poem, 1819–23.

Don Juan OF AUSTRIA. (1) See JOHN OF AUSTRIA. (2) 1629–1679. Natural son of Philip IV. of Spain; Gov. of Spanish Netherlands 1656–59.

Donkey. See ASS.

Donkey-boiler and Engine. Subsidiary apparatus, smaller than the main engine plant, for use in pumping, hoisting, or other work, when a vessel is in port; thence, any smaller or additional machine for work independent of the larger design to which it may belong.

Donkey Party. Game in which the players blindfolded in turn pin tails upon a cloth with the picture of a tailless donkey. A somewhat similar custom exists in China, where a blindman paints with various colors the outline drawing of an ox, on which the predominant color is then regarded as an omen for the year.

Donne, JOHN, D.D., 1573–1631. English divine and poet; prominent in the "Metaphysical" school. His reputation was made before he took orders, 1615. *Pseudo-Martyr*, 1610.

Donnelly, IGNATIUS, b. 1831. Expounder of the Bacon-Shakspeare theory, and of others as to the ancient world in *Atlantis*, 1882, and *Ragnarok*, 1883; Lt.-Gov. of Minn. 1859–63, M. C. 1863–69.—His sister, ELEANOR CECILIA, b. 1838, has pub. much verse.

Donner, JOHANN JACOB CHRISTIAN, 1799–1875. German translator of Greek and Latin poets; prof. at Stuttgart.

Donnybrook Fair. Held annually near Dublin ab. 1205–1855; noted for brawls and riots.

Donoghue, JOHN. American sculptor; he had important exhibits at the World's Fair, Chicago. *The Young Sophocles leading the Chorus of Victory after the Battle of Salamis, Kypros*, and *Hunting Nymph*.

Donoso, JUSTO, 1800–1868. Chilian bishop and writer on canon law.

Donoso Cortes, JUAN FRANCISCO MARIA, MARQUIS DE VALDEGAMAS, 1809–1853. Spanish Minister to Prussia 1848; author of *Catholicism, Liberalism, and Socialism*, 1851.

Don Quixote. Hero and title of CERVANTES' (q.v.) famous novel, 1605–16.

Donus I. Pope 676–678. Donus II., 974, is a myth.

Doo, GEORGE THOMAS, F.R.S., 1800–1886. English line-engraver.

Doolittle, CHARLES LEANDER, b. 1843. Prof. Math. Lehigh Univ. 1875–95, Univ. Pa. 1895. His *Observations on Latitude* appeared mainly in *Astron. Nachrichten* and *Astr. Journal*, 1875 and later, and attracted wide attention.

Doom. Old name for the Last Judgment, usually painted over the chancel-arch in churches. At the Reformation these pictures in distemper were generally effaced as superstitious.

Doomsday Book. See DOMESDAY BOOK.

Doon. River of s.w. Scotland, 30 m. long; celebrated by Burns.

Door-Weed. See KNOTGRASS.

Dope. Substance, usually inert, like infusorial earth or scales of mica, but sometimes itself explosive or chemically active, used as an absorbent of nitroglycerine in many of the high explosives used in blasting.

Döppler's Principle. That on which depends the apparent change of pitch when a sounding body is made to approach or recede from the observer. If the two are coming nearer together, the pitch is apparently raised; if separating, it is lowered. The same principle may be applied to light waves: under these circumstances the refrangibility is slightly altered.

Dora d'Istria, 1829–1888. Roumanian author; pen-name of Helena, dau. Prince Ghika, m. 1849 to Prince Koltzoff Massalsky. *Women in the Orient*, 1858; *Monastic Life*, 1865; *Poetry of the Ottomans*, 1873.

Doran, JOHN, LL.D., 1807–1878. English historical writer; ed. *Notes and Queries*. *Table Traits*, 1855; *Knights*, 1856; *Monarchs Retired*, 1857; *Court Fools*, 1858; *Their Majesties Servants*, 1864; *Saints and Sinners*, 1868; *Drury Lane*, 1885.

Dorcas. Beneficent woman of Joppa, whom St. Peter restored to life. Her name has been adopted by innumerable associations of ladies who meet to sew for the poor.

Doré, GUSTAVE PAUL. 1833–1883. French painter, who illustrated Dante's *Inferno* 1861, the Bible 1865–66, and many other works in a style of much imaginative power.

Gustave Paul Doré.

Doremus, ROBERT OGDEN, M.D., LL.D., b. 1824. Prof. Chemistry Coll. N. Y. City 1851; Bellevue Med. Coll. 1861. —His mother, SARAH PLATT (HAINES), 1802–1877, was a noted philanthropist.

Doria, ANDREA, 1468–1560. Genoese admiral 1513. He fought the African pirates, commanded the French fleet against Charles V.; restored republican institutions to Genoa 1529, defeated the Turks near Patras 1532, and aided in conquest of Tunis 1535.

Dorian Colonies. See COLONIES, GRECIAN.

Dorians. See DORIS.

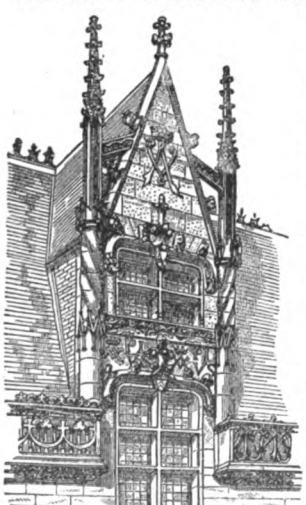
Doric. Dialect of classical Greek, found in the works of Pindar, Theocritus, and others.

Doridæ. See PYGOBRANCHIA.

Doris. Small district in Hellas; home of the Dorian race which conquered the Peloponnese, and planted colonies in Crete, Asia Minor and Sicily.

Dormant Partner. One who is unknown to the world and takes no part in the business.

Dormer Window. An opening above the eaves of a house, commonly in the same plane with the wall below, and intended to give light to a room constructed in the roof. In late French Gothic the dormers were treated with great richness and were among the chief decorative features of the buildings in which they were employed.



Dormer Window.
(From the Chateau de Josselin, Brittany, end of the 15th century.)

Dormouse. Small rodents of the Old World related to mice but having bushy tails and squirrel-like appearance, habits, etc. Are noted for their hibernating whenever the weather is cold.

Dorner, ISAAC AUGUST, 1809–1884. German theologian; prof. at Kiel 1839, Königsberg 1843, Bonn 1847, Göttingen 1853, and Berlin from 1862. *Doctrine of the Person of Christ*, 1839, tr. 1861–63, 5 v.; *Hist. Prot. Theology*, 1867, tr. 1871; *Christian Doctrine*, 1879–80, tr. 1880–84, 4 v.; *Ethics*, 1885, tr. 1887.

Dorpat. Town of Livonia, Russia, founded 1030; once of the Hanseatic League; taken by Swedes 1625, by Russians 1704. Its university was founded by Gustavus Adolphus 1632, reconstituted by Alexander I. 1802, and Russianized since 1887; it has 5 faculties, 73 professors, and nearly 2,000 students. Pop., 1891, 40,884, mainly German.

Dorr's Rebellion. Movement, 1841–42, led by Thos. W. Dorr (1805–1847) to extend the right of suffrage in R. I. He organized a party which framed a constitution, held an election, and made an unsuccessful attempt to seize the State government. Dorr was tried for treason, sentenced for life, but released 1847.

Dorset, EARL OF. See SACKVILLE

Dorset, HORNED. See SHEEP.

Dorsey, JAMES OWEN, b. 1848. Ethnologist, who has written much on the N. W. Indians.

Dorsibranchiata. *Errantia*, with branchiæ on the parapodia.

Dorsiferous, DORSIGEROUS, or DORSIPAROUS. Bearing young on the back, as certain Toads, Opossum, etc.

Dorsigrade. Walking on back of toes, as certain Armadilloes.

Dorsimeson. Middle line of back.

Dorsiventral. Organs of a plant or animal which have two surfaces of different structure, exhibiting different phenomena.

Dorso-Ventral. Pertaining to a line drawn from the back to the belly through an animal.

Dort, SYNOD OF. Called by States-General of Holland, held at Dordrecht 1618–19, to condemn Arminianism: attended by deputies from England and most of the Calvinistic bodies of Europe.

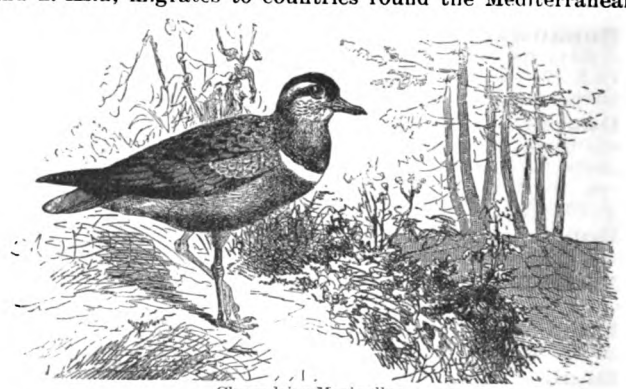
Dortmund. Town of Westphalia on the Emscher, ceded to Prussia 1815. It is in an iron and coal mining region, and has large manufactures of iron and steel. Pop., 1890, 89,663.

Dorylæum. Town in Phrygia; scene of victory of first Crusaders over Turks, July 1, 1097.

Dose OF CAPITAL OR LABOR. One of the successive amounts of capital or labor, or both, which are applied to land in the process of its cultivation.

Dostoyevski, FEDOR MIKHAILOVITCH, 1822–1881. Russian novelist, sent to Siberia 1849 for ten years, but never a Nihilist. His books were full of power and sympathy, and extremely popular at home. *Poor Folk*, 1846, tr. 1894; *The Downtrodden*, 1861; *Bad Hearts*, 1867; *Crime and Punishment*, 1868; *The Idiot*, 1869; *Podrostok*, 1875.

Dotterel. *Charadrius morinellus.* Found in e. Europe and n. Asia; migrates to countries round the Mediterranean.



Charadrius Morinellus.

They are excellent for food when in season. It changes its plumage in summer and winter. On account of its actions it has become proverbial for stupity.

Douai, or DOUAY. Ancient fortified town of n. France, on the Scarpe, 20 m. s. of Lille; held successively by Flanders, Burgundy, and the Spanish Netherlands; taken by the French 1667, by Marlborough June, 1710; restored 1712; seat of a university founded by Philip II. 1562, with an English college founded by Wm. Allen 1568. The college was of vital importance to the R. C. Ch. in England, but was suppressed 1793. Pop., 1891, 29,909.

Douay Version. Of the Bible into English from the Vulgate; made by members of the R. C. College. The N. T. was pub. at Rheims 1582, the O. T. at Douai 1609.

Double-Bass. Largest instrument of the viol tribe, which provides the fundamental tone in orchestral music. It sounds an octave lower than the music written for it, being what is called a transposing instrument of 16 ft. tone. It has three or four strings and is too unwieldy for solo playing, though Dragonetti and Bottesini were virtuoso performers on it.

Doubleday, ABNER, U. S. A., 1819–1893. General of Vols. 1862–65. *Chancellorsville and Gettysburg*, 1882.

Double Decomposition. Chemical reaction taking place between two compounds both of which are decomposed and two new compounds formed; *e.g.*,

$$AgNO_3 + NaCl = AgCl + NaNO_3.$$

Double Float. Contrivance for measuring the velocity

of a river, consisting of a large float sunk below the surface and connected by a cord to a smaller one on the surface.

Double-Headed Rail. Railroad rail having the lower flange like the head, so as to be reversible; used only in England.

Double Images. Normal vision being binocular, the rays of light from any object falling upon the eyes must produce an image on each retina. Usually these two images are combined and perceived by the mind as one, and the object appears single; but under certain circumstances the two are not combined, but produce a double image of the object. This is readily shown by holding up the two forefingers vertically in front of the eyes and ab. a foot from each other. If now the eyes be focused so that the nearer finger be seen distinctly as single, the further finger will be seen double; and similarly, if the further finger be focused, the nearer one will appear double.

The phenomenon is partially explained by the existence in the retinæ of so-called identical points, *i.e.*, points in each retina corresponding to points in the other upon which, if rays of light from an object fall, the object is perceived as one, while if the rays fall on non-corresponding or disparate points, the object is seen as two. The rays are brought to identical points on the retinæ by means of the mechanism of accommodation of the eye. See VISION.

Double Refraction. If a luminous point be viewed through any transparent crystal except one belonging to the isometric system, two images at least of the point will be seen. If the two rays to which the crystal gives rise be examined, it will be found that one suffers refraction according to the ordinary laws, and is called the "ordinary ray," while the other is refracted according to a new and different law, and is called the

Double Images seen through Iceland Spar.

"extraordinary ray." This phenomenon was discovered and studied by Bartholinus 1669 at Copenhagen with some crystals of Iceland spar brought from the Bay of Roërford in Iceland. In every doubly refracting crystal there is always one direction along which if a ray be transmitted it will not be divided; this line is called the "optic axis," and all the phenomena of double refraction are symmetrical with reference to it.

Double Riveting. Joint in which two rows of rivets are used. The strength of a double-riveted joint is about 70 per cent of that of the solid plate.

Double Salts. Compounds composed of two or more molecules of different salts; *e.g.*, $AuCl_3KCl;K_2SO_4.Na_2SO_4$.

Double Shear. A rivet is said to be in double shear when one half of the stress upon it is carried toward one end and the other half to the other end. Thus the stress tends to cut off, or shear, the rivet in two places. In ordinary lap joints the rivets are in single shear.

Double Standard of Value. Monetary system in which both gold and silver, in a fixed proportion, are full legal tender and have equal regard as money.

Double Touch. One of the three principal methods of magnetization. The two opposite poles of a pair of powerful magnets separated by a small strip of wood are placed in the middle of the bar to be magnetized, and then moved together, first toward one end, and then toward the other, the process being repeated several times. The motion should cease at the middle, where it started, and care should be taken that each half is operated on the same number of times.

Double Weighing. Method suggested by Borda for finding the true weight of a body. Place the body in one of the pans of a balance and counterbalance it with sand, shot, or other convenient material. Now remove the body and replace it by standard weights till the balance is restored; these weights are evidently equal to the weight of the body, and no account needs to be taken of the errors of the instrument.

Doubloon. Spanish gold coin, till 1848 equal to two pistoles or ab. $16.

Doubt. See SKEPTICISM.

Doubting Insanity. Variety in which person affected questions the truth of every statement and indulges in frivolous arguments upon the slightest grounds.

Douce, FRANCIS, 1757–1834. English antiquarian. *Illustrations of Shakespeare*, 1807; *Dance of Death*, 1833.

Doucet, LUCIEN, b. 1856. French portrait and figure painter.

Dougherty, DANIEL, 1826–1891. Phila. lawyer, noted for eloquence.

Doughty, THOMAS, 1793–1856. American landscape painter.

Douglas, AMANDA MINNIE, b. 1838. American novelist. *Claudia*, 1867.

Douglas, GAWAIN or GAVIN, 1474–1522. Scottish poet; Bp. of Dunkeld 1515; son of Archibald, fifth Earl of Angus. *Palace of Honor*, 1501; tr. *Æneid* 1512. He died of the plague in London.

Douglas, SIR HOWARD, 1776–1861. Gov. of New Brunswick 1823–29; M. P. 1842–46. *Military Bridges*, 1816; *Naval Gunnery*, 1819; *Naval Evolutions*, 1832.

Douglas, STEPHEN ARNOLD, 1813–1861. Judge Ill. Supreme Court 1841–43; M. C. 1843–47; U. S. Senator from 1847; Presidential Candidate 1860. He was a warm supporter of the doctrine of "squatter sovereignty," by which each State was to say whether or not it would permit slavery within its limits. The support of this doctrine in the bill for the admission of Kansas and Nebraska caused widespread opposition and made the extension of slavery the paramount issue in the country.

Douglass, FREDERICK, 1817–1895. Most eminent of American negroes. He escaped from slavery in Md. 1838, gained fame as a public speaker, edited papers at Rochester and Washington, was U. S. Marshal Dist. Columbia 1877–81, and Minister to Haiti 1889–91. He pub. 3 vols. of autobiography, 1844, '55, '81.

Douro. River of Spain and Portugal; crossed by Wellington after a severe battle with the French under Soult, May 12, 1809. It rises in the Castilian Mts., flows nearly w., and enters the Atlantic 3 m. s. of Oporto. Length ab. 500 m.

Douville, JEAN BAPTISTE, 1794–1835. French traveler and impostor, who won honors by 3 vols., pub. 1832, narrating imaginary explorations in Africa.

Dove. Bird used in sacrifice by the Jews, and in Christian art from 6th century as an emblem of the Holy Ghost. See PIGEON.

Dove, HEINRICH WILHELM, 1803–1879. Prof. Berlin 1845; director Royal Meteorological Inst. there 1848. Founder of the Prussian System of Meteorology and Climatology, and of the modern system of climatological studies of periodic and non-periodic phenomena. He made sundry optical and other researches (see DOVE'S LAW).—His son, RICHARD WILHELM, b. 1833, Prof. Tubingen 1862, Kiel 1865, and Göttingen 1868, deputy 1871, is an eminent jurist.

Dover. Seaport of England, opposite Calais; fortified by William I. It stands at the entrance of a deep depression. A favorite summer resort on account of its healthfulness and the

Dover.

surrounding scenery. It is defended by Dover Castle, which is built on chalk cliffs 320 ft. high and supposed to have been founded by the ancient Romans. Pop., 1891, 33,418.

Dover. Capital of Delaware; in Kent co. Pop., 1890, 3,061.

Dover. City of Strafford co., New Hampshire, on Cocheco River, which is tidal and navigable; founded 1623. Pop., 1890, 12,791.

Dover, STRAIT OF. Passage connecting the North Sea with the English Channel, and separating England and France.

Dover's Powder. Sudorific, composed of 8 parts sugar of milk and 1 each opium and ipecacuanha; prescribed by Thomas Dover, 1660–1742, the rescuer of A. Selkirk.

Dove's Law OF ROTATION OF WINDS. Generalization announced by Dove 1827, that in the n. temperate zone the changes in direction of the wind at any locality go through a period

lasting usually only a few days and most frequently in the order E., S., W., N., or in the direction of the apparent daily course of the sun or "with the sun": in the southern hemisphere the order is reversed. This law was known even to Aristotle for the eastern Mediterranean countries, but Dove showed the great generality of the rule: his theoretical explanation of the cause is now replaced by the laws of cyclones.

Dovetail. Form of joint much used in carpentry and engineering construction, for framing members together; named from its shape, the tenon part being broader at the end than at the root. It can therefore enter the mortise only at the end, and when in place and pinned from endwise motion, a very strong joint is made. In machine-tool construction, the ease with which such a joint can be adjusted and tightened by a wedge has caused its general use in certain arrangements about the tool-carriages.

Dow, or **Douw,** GERARD, 1613–1675. Dutch painter, much given to candle and lantern scenes and effects of light and shadow. His pictures are small, painstaking, and minute in their execution.

Dow, LORENZO, 1777–1834. American preacher, noted for eccentricity and eloquence.

Dow, NEAL, b. 1804. Author of the "Maine law," 1851; Brig.-gen. of Vols. 1862–65; Prohibition candidate for Pres. 1880.

Dowager. Widow with dower; also widow of a royal or titled person.

Dowden, EDWARD, LL.D., b. 1843. Prof. Univ. Dublin since 1867; biographer of Southey and Shelley, 1879–86. *Shakespeare*, 1875; *Studies in Literature*, 1878.

Dowel. Pin holding two plates in position, but not penetrating through either.

Dower. At Common Law, life estate given by law to the widow in one third of the real property owned by the husband during marriage and descendible to her heirs, barred only by her own act; abolished in Britain and some of the U. S., and generally governed by modern statutes.

Dowie, MENIE MURIEL (MRS. HENRY NORMAN). English traveler. *A Girl in the Karpathians*, 1891.

Dowlais. Suburb of Merthyr-Tydvil, Glamorganshire, Wales, having extensive iron and steel works.

Dowlas. Coarse linen, formerly much used in England and Scotland.

Dowling, JOHN, D.D., 1807–1878. Anglo-American Baptist. *Hist. Romanism*, 1845.

Downcast. Shaft through which fresh air enters a mine.

Downing, ANDREW JACKSON, 1815–1852. American horticulturist. *Landscape Gardening*, 1841; *Fruit Trees*, 1845; *Country Houses*, 1850; *Rural Essays*, 1853.

Downing Street. In Whitehall, London; named from Sir George Downing, Sec. Treasury 1667. Here are the Colonial and Foreign Offices, where cabinet meetings are held.

Downs, NORTH and SOUTH. Two chalk ridges extending from Hampshire to Dover and Beachy Head respectively; length ab. 120 and 80 m.; greatest ht. 880 ft.

Downs, THE. Natural harbor on e. coast of Kent, 8 by 6 m., protected by Goodwin Sands.

Downs Sheep. See SHEEP.

Downthrow. Displacement of strata which causes one part to lie at a lower level than another.

Dowsing Rod. See DIVINING ROD.

Doxology. Utterance of praise. Its two ancient forms, called Greater and Lesser, are the *Gloria in Excelsis* and *Gloria Patri*. The latter has been repeatedly versified, and in various paraphrases, especially that of Bp. Ken, is sung in Protestant worship at the close of hymns or by itself.

Doyen, GABRIEL FRANCOIS, 1726–1806. French painter, known in Paris by the *Death of Virginia* and *Miracle des Ardents;* director of the St. Petersburg Academy from 1791.

Doyle, A. CONAN, M.D., b. 1859. English novelist, nephew of RICHARD. *A Study in Scarlet*, 1888; *Micah Clarke*, 1889; *Sign of the Four*, 1890; *White Company*, 1891; *The Refugees*, 1893; *Sherlock Holmes*, 1893–94; and a play, *A Story of Waterloo*, 1894.

Doyle, SIR FRANCIS HASTINGS, 1810–1888. Prof. Poetry at Oxford 1867–77.

Doyle, RICHARD, 1824–1883. English caricaturist, connected with *Punch* till 1850; widely known by his illustrations of many books.

D'Oyly, GEORGE, D.D., 1778–1846. Anglican divine; editor with Bp. Maut of an annotated Bible pub. 1814 by the S.P.C.K.

Dozy, FRANZ, 1807–1856. Physician and botanist in Leyden. *Bryologia Javanica*, 1855–70.

Dozy, REINHART, 1820–1883. Prof. History at Leyden from 1850; Orientalist. *Spain in the Middle Ages*, 1849–60; *Hist. Mussulmans of Spain*, 1861; *Supplement to Arabic Dictionaries*, 1877–81.

Drachenfels. One of the Siebengebirge, a castle-crowned hill on the Rhine 8 m. above Bonn. It commands a magnificent view to Cologne in the distance and contains a legendary dragon cave.

Drachma. Standard Greek silver coin. Two different scales of value prevailed, the Attic, worth ab. 19 cents, and

Athenian Drachma.

the Æginetan, 25 cents. Six oboloi made a drachma, 100 drachma a mina, and 60 minæ a talent. The later Macedonian standard seems to have been worth over 30 cents.

Drachmann, HOLGER HENRIK HERHOLDT, b. 1846. Danish poet and novelist, originally a marine painter.

Draco. Northern constellation of third-magnitude stars winding round the Pole between the two Bears to Cepheus and back to two second-magnitude stars in the head under Hercules. The brighter of these two, called Rasteben, is the one used in calculating the coefficient of aberration of the fixed stars.

Draco. Athenian lawgiver ab. 621 B.C. His laws punished nearly all crimes by death, and were mostly replaced by those of Solon 594.

Draco, 2d century. Grammarian of Caria, Asia Minor. Most of his works are lost.

Dracontius, ab. 490. Latin poet of Spain or Africa. His *Hexæmeron*, describing the six days of creation, is part of a longer poem, *De deo*.

Dracunculus Medinensis. See FILARIA MEDINENSIS.

Dræseke, FELIX, b. 1835. German composer, follower of Liszt.

Draft. 1. Bill of exchange. 2. Document drawn up for consideration.

Draft Riots. In N. Y. City, July 13–16, 1863, resulting in the murder of negroes, the loss of several hundred lives, and the destruction of much property. They were the protest of the mob against the enforcement of the Draft, and was quelled by Pa. militia and veteran regiments from Va.

Drag. Loss of head in a current of air circulating in a mine; caused by friction on the walls of the air passages.

Dragoman. Guide or conductor for travelers in the East; interpreter in the service of a court or embassy.

Dragon. See CRASSILINGUIA.

Dragon. Fabulous animal found in the legends of all nations as a type of difficulty, danger, or evil, for heroes to conquer. As the Hydra it was sentinel in the Garden of the Hesperides, and among the ancient Germans as with the early Greeks it was symbolic of the hero. In Christian art it is the type of sin and Satan.

Dragon, GREEN. *Arisæma dracontium.* Curious herb of the natural family *Araceæ*, native of e. N. America, growing in swampy woods; nearly related to Jack-in-the-Pulpit, also called Dragon-root and Dragon-Arum.

Dragonetti, DOMENICO, 1755–1846. Italian double-bass player. He was an eccentric man, who carried about a black doll on his artistic tours, called it his wife, and compounded a patois for his own use of Italian, French, English, and other words.

Dragon-fly. See LIBELLULIDÆ.

Dragon-Head. Species of *Dracocephalum*, a genus of plants of the Mint family, native of the n. hemisphere.

Dragon-Head, FALSE. See OBEDIENT PLANT.

Dragonnades. Harrying of French Protestants 1681–85, by quartering dragoons in their houses, and subjecting them to the license and plunder of these soldiers. Many were by this means induced to recant and join the R. C. Ch.

Dragon's Blood. *Calamus draco.* Slender palm, native of Malaya. Its fruits, when ripe, are densely covered with a scaly, resinous substance, collected in large quantities and used for staining and varnishes.

Dragon's Blood Tree. *Dracœna draco.* Large tree of the Lily family, native of the Canaries and neighboring shores of Africa. A red substance used as a varnish is obtained from secretions at the base of the leaves.

Dragon Tree (*Dracœna draco*).

Dragoons. Originally troops that fought as cavalry and infantry skirmishers, now cavalry, the distinction having ceased to exist in the U. S. Army. Before 1861 it had two regiments of dragoons.

Drainage. Process of removing water from the soil by means of open or underground artificial conduits. It is of benefit both in removing surplus water and admitting air to the pores of the soil, whereby chemical action resulting in the setting free of plant-food is induced. It has been extensively carried on in all parts of the world. In Holland large tracts have been reclaimed from the inundations of the ocean by the construction of dikes and by pumping. The sanitary condition of a country is found to be greatly improved by the drainage of marshes and low lands. The drainage of cities is effected by sewers, which were first built by the Romans. The drainage canals and tunnel, completed 1894, for the protection of the City of Mexico, are among the greatest engineering works of modern times.

Drainage Canal. Built to carry away waste water from mines, or sewerage from cities. The Chicago canal, now in construction, is the largest ever built, and will also serve as a ship canal.

Drainage Tubes. Tubes of metal, rubber or bone, from which mineral matters have been removed by acids, introduced and allowed to remain in wounds or cavities containing pus or fluid for which it is desirable to furnish a ready outlet.

Drain Pipe. Clay or cement pipe, made in sections, and used for draining land or for carrying house wastes to the sewer.

Drake, CHARLES DANIEL, 1811–1892. U. S. Senator from Mo. 1867–71; Chief Justice of U. S. Court of Claims 1871–1885. *Law of Attachments*, 1854.—His uncle, BENJAMIN, 1794–1841, pub. lives of Black Hawk, Gen. Harrison, and Tecumseh, 1838–41.

Drake, SIR FRANCIS, ab. 1540–1596. English sailor, knighted 1580, M.P. 1584–85. He harried the Spanish-American settlements 1572–73; sailed up the Pacific coast 1578–79, and circumnavigated the globe; destroyed part of the first Armada in Cadiz harbor 1587; and had a share in defeating the Armada of 1588.

Sir Francis Drake.

Drake, FRIEDRICH, 1805–1882. German sculptor; prof. Berlin.

Drake, JOSEPH RODMAN, 1795–1820. American poet. *The Culprit Fay.*

Drake, NATHAN, M.D., 1766–1836. English Shakespearean.

Drake, SAMUEL, 1768–1854. Anglo-American actor.

Drake, SAMUEL GARDNER, 1798–1875. American antiquarian. *Book of Indians*, 1833; *Boston*, 1856; *Annals of Witchcraft*, 1869; *French and Indian War*, 1870.—His son, FRANCIS SAMUEL, 1828–1885, pub. *Dictionary of American Biography*, 1872, and *Life of Gen. H. Knox*, 1873.—Another son, SAMUEL ADAMS, b. 1833, has written much on New England topics.

Drakenberg. Range in the Transvaal, s.e. Africa, parallel with the Indian Ocean and ab. 120 m. from it. Greatest height 10,360 ft.

Drakenborch, ARNOLD, 1684–1748. Prof. Utrecht; editor of Livy and Silius Italicus.

Drama. 1. Performance on the stage of imitations of human life, conduct, and sentiments. 2. Plays written to be thus produced.—Greek tragedy was furnished by Æschylus, Sophocles, and Euripides; comedy by Aristophanes. Roman comedy survives in Plautus and Terence. With the revival of learning the drama came to be cultivated in s., central, and w. Europe; the Scandinavian and Slavonic countries followed. Shakespeare, Molière, Goethe, and Schiller hold the highest rank; Italy, Spain, and France have produced other dramatists of fame. Oriental nations, as the Chinese and Hindus, have a drama peculiarly their own.

Dramatic Music. Used in connection with the drama, whether spoken, sung, or simply acted (ballet, pantomime); distinguished from Chamber and Church music. Besides LYRIC DRAMA, OPERA, and the OVERTURE (q.v.), there are Entr' acte, or Between-Acts music, and Melo-dramatic music, designed to accompany spoken words or mere action. Ideally considered, the purpose of such music should be to heighten the effect of the play, keep the listeners in the mood excited by the progress of incident, prepare the mind gradually for what is to come by suggesting its temper, and to do this without demanding an undue share of attention. These aims are strikingly exemplified in Beethoven's *Egmont* music; Weber's *Preciosa*, and Mendelssohn's *Midsummer Night's Dream.*

Draper, ANDREW SLOAN, LL.D., b. 1848. N.Y. Supt. of Instruction 1886–92; prolific writer on public schools.

Draper, JOHN WILLIAM, M.D., LL.D., 1811–1882. Prof. Univ. N.Y. 1839. *Organization of Plants*, 1844; *Human Physiology*, 1856; *Intellectual Development of Europe*, 1863; *Hist. American Civil War*, 1867–68; *Science and Religion*, 1874.—Of his sons, JOHN CHRISTOPHER, M.D., LL.D., 1835–1885, and HENRY, M.D., LL.D., 1837–1882, were physiologists, the latter making a specialty of celestial photography; DANIEL, Ph.D., b. 1841, became in 1869 director of the N.Y. Meteorological Observatory, and invented a system of self-registering apparatus.

Draper, WILLIAM HENRY, 1801–1877. Judge of Canada Queen's Bench 1847. Chief-Justice of C. P. 1856, Chief-Justice of Upper Canada 1863, Pres. Court of Errors 1869. *Reports of King's Bench*, 1829–31.

Drapery. In sculpture and painting, the representation of the clothing of human figures, especially as an expression of action or character; also tapestry, hangings, and curtains.

Draughts. Also called checkers. This game is played between two persons upon a board containing sixty-four squares of alternate colors with twelve round disks of wood or bone, called men, each. These men are moved by the players alternately in diagonal directions and a piece or man may be jumped and thus taken from the board. The game thus continues until one or the other has lost all his men or is unable to move them. It is said to have come from the East in 16th century.

Drave. Righthand branch of the Danube, in Austro-Hungary. Length 447 miles, drainage area 15,562 sq. m.

Dravidian Languages. Group found in the s. part of India; said to belong to the Scythian family.

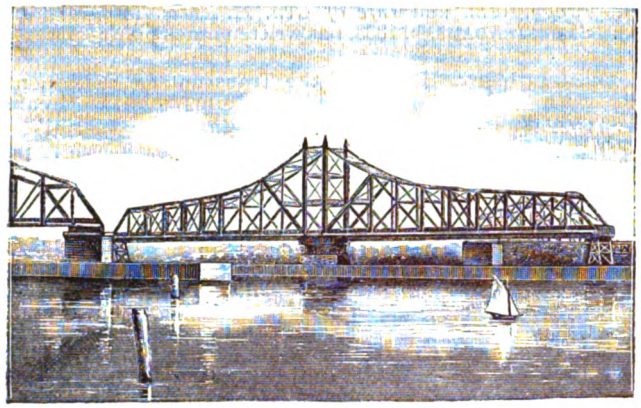
Draw. Term applied to a variety of poker called in full Draw-poker. See POKER.

Drawback, IN FINANCE. Sum of money returned by the Government on the exportation of goods from which a tax of like amount had been previously collected. It is a device for enabling the Government to lay an internal duty on goods and yet not raise their price when they are destined to compete with other similar goods in a foreign market.

Draw-Bar. Bar which connects one railroad car with another and transmits the force necessary to pull the train behind it.

Drawbridge. Bridge which can be lifted up or swung around so as to permit vessels to pass. The figure shows the longest ever constructed, 503 feet; it was built 1889 over the Thames at New London, Conn. A swinging drawbridge is

usually of the continuous type when closed, and of the cantilever type when open. A number of these, with lengths over 400 feet, have been built across the navigable rivers of the U. S.



Drawbridge.

In military engineering, a drawbridge is used to sever the communication over the ditch of a fortress or to open water communication in a bridge across a river.

Drawing. Freehand drawing is that done without the use of tools other than a pen or pencil. Mechanical drawing requires the use of special pens, dividers and other tools. Mechanical or projection drawing represents objects by two or more views, called plans, elevations and sections, while the principal dimensions are added for the use of the artisan.

Drawing. In coal-mining, removal of pillars after the completion of the breast workings.

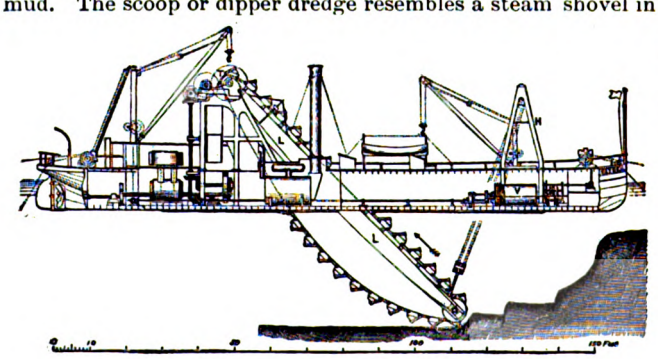
Drawing and Quartering. English penalty for treason, abolished 1870. It implied hanging and beheading prior to the dividing of the culprit's body. The "drawing" was on a hurdle to the gallows.

Drawn Tubes. Tubes or pipes of wrought iron, drawn out when hot from a solid bar, thus making a hollow cylinder without a weld.

Drayton, MICHAEL, 1563–1631. English poet. *Polyolbion*, 1613.

Dreaming. Condition, during sleep, in which there is absence of volitional control over the current of thought which proceeds automatically and usually incongruously. Thinking is performed with great rapidity, a few seconds sufficing for conception of events extending over years, thus resembling the rapid survey of a person's life when one is in imminent danger of death. Usually dreams which occur during interval between sleeping and waking are most vivid and best remembered. Often there is consciousness of dreaming, and it may be prolonged or arrested by the will.

Dredge. Machine by which earth and mud can be raised from the bottom of a river or harbor. A common form is that having a series of buckets arranged on an endless chain. The clam-shell dredge has two scoops opening outward from a common hinge; these can be closed after being lowered into the mud. The scoop or dipper dredge resembles a steam shovel in



Dredging-machine.

appearance and manner of operation, and is a good form for a low lift. The hydraulic dredge is a pump which can lift sand and mud, when mingled with water, and force it through a flexible pipe to a scow or other receptacle. The cost of dredging varies from 3 to 20 cents per cubic yard of material, depending upon the character of the material and the distance to which it is moved.

Dred Scott Case. Decided by Chief-Justice Taney of U. S. Supreme Court 1856, to the effect that Scott, a slave who had been taken by his master from Mo. to Ill. and Wis. and back to Mo., if free, was not a "citizen of a State," and so could not bring the action; and besides, that he was still a slave. It held also that the Act of Congress prohibiting slavery n. of 36° 30′ was unconstitutional and void.

Dreh-strom. Tri-phase system of alternating currents differing by ⅓ period (120°). By this means a rotating magnetic field may be generated.

Drelincourt, CHARLES, 1595–1669. Huguenot pastor at Charenton, a suburb of Paris, from 1620. His *Christian's Defense against Fear of Death*, 1651, tr. 1675, was so popular that De Foe in 1705 made Mrs. Veal's ghost praise it.

Drepanium. Modification of the cymose flower-cluster.

Drepánum. In n.w. Sicily; now Trápani; stronghold of the Carthaginians, who gained a great naval victory here over the Romans 249 B.C.

Dresden. Capital of Saxony in 1270 and from 1485; on the Elbe. It is irregularly but beautifully planned, and contains extensive artistic, literary and scientific collections. The Allies under Schwartzenberg were defeated here by Napoleon, Aug. 26 and 27, 1813. The Prussians occupied it 1866. Pop., 1890, 276,085.

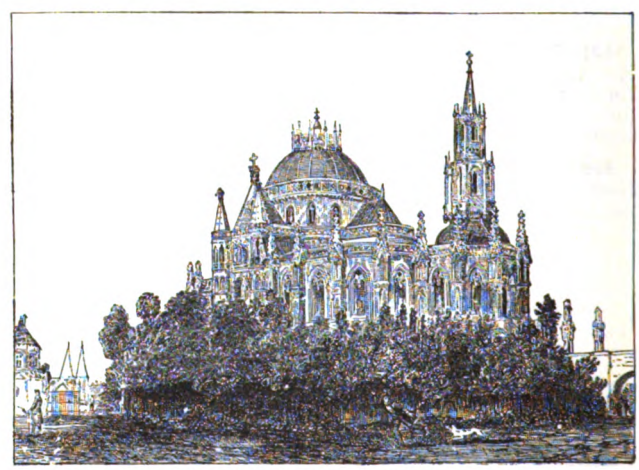
Dresden, PEACE OF. Concluded Dec. 25, 1745, between Austria, Prussia and Saxony, ending the 2d Silesian War.

Dresden Gallery. One of the finest in Europe, dating its importance from acquisition 1745 of 100 paintings from the Modena Gallery. It now contains ab. 2,500 pictures. The *Sistine Madonna* by Raphael was obtained from Piacenza 1753. Next to this may be ranked the *Meyer Madonna* by Holbein. Here are also Correggio's *Holy Night*, Titian's *Christ* and the *Tribute Money*, and important works by Giorgione, Paul Veronese, Rembrandt, Rubens, and all the greatest masters of oil painting.

Dress. See COSTUME.

Dresser, HENRY ERLES, b. 1838. English ornithologist. *Birds of Europe*, 8 v., 1871–81.

Dreux. Town of n. w. France on the Blaise R., regularly built and commanded by an eminence crowned by the ruins of the ancient castle of the Counts of Dreux and by the royal chapel where the Orleans princes are buried. Its position al-



The King's Chapel, Dreux.

ways made it a place of strategic importance. The Romans established a stationary camp here, the English held it 1422–1437, Condé was defeated and captured here by Montmorency 1562, Henry IV. took it by siege 1593, and the Germans occupied it Nov. 1870. Pop., 1891, 8,520.

Drew, JOHN, 1825–1862. Irish-American actor, prominent in Irish parts from 1845.—His wife LOUISA (LANE), b. 1820, m. 1850, is a well-known actress and manager.—Their son JOHN, b. 1853, has been on the stage since 1872.

Drew Theological Seminary. Founded 1866 at Madison, N. J., by Daniel Drew, 1797–1879, for the M. E. Ch. It has 8 professors, ab. 150 students, and library of ab. 32,000 vols.

Drexel, ANTHONY JOSEPH, 1826–1893. Banker; founder of the Drexel Institute for industrial training, in Phila., 1890.

Dreyse, JOHANN NIKOLAUS VON, 1787–1867. German machinist, inventor 1827–36 of the needle-gun, adopted in Prussian army 1840; ennobled 1864.

Drift. Sheet of gravel, sand, clay, and bowlders overlying a great part of the n. and portions of the s. hemisphere, derived from countries in higher latitudes and spread over the surface by ice during the GLACIAL ERA (q.v.).

Drift. Horizontal passage in a mine, lying in the plane of the deposit, and following its strike. A dumb drift is a similar passage constructed to carry an air current around a ventilating furnace.

Drifting, or DRIVING. In Mining, process of extending excavations in a horizontal direction; contrasted with raising and sinking.

Drift-Pin. Conical bar or pin of steel, used by riveters in boiler and bridge work to enlarge holes which have not been so made in the seam as to come exactly opposite. The taper pin is inserted and driven in by the hammer, stretching the two edges upon which it bears till the two holes coincide. Drifting distresses the metal and puts it under an initial strain if carried to any extent. It is forbidden in most specifications for riveted work.

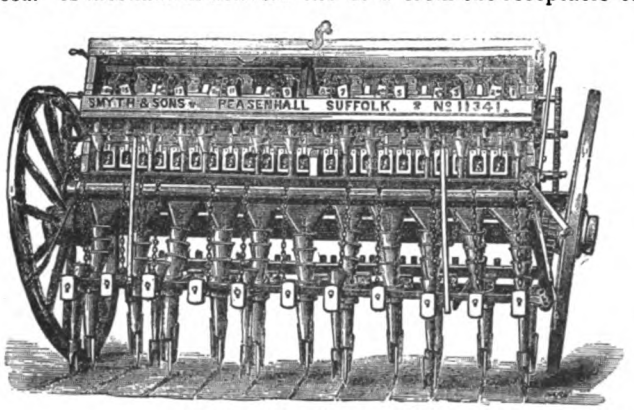
Drift Theory. Advocated originally by Ferrel. It makes the general motion of even the largest storm-centers depend wholly on the movement of the mass of air in which the storm may be considered to be imbedded.

Drill. See MANDRILL.

Drill. Tool for making holes in metal or stone, and machine which drives it. The cutting edge of a drill is a wedge, and for stone it acts by percussion to comminute the material. (See ROCK-DRILLS.) For metal, there are two wedge edges meeting at the center on a line which should be the axis of the hole to be drilled. The flat drill is made of a flat bar of steel, the end being forged and ground to proper shape; the twist drill is made from a round bar, of the size of the hole, with spiral grooves milled down its surface from the shank to the point. Twist drills are more likely to drill a hole straight and round. The drilling apparatus may be driven by hand or power. The usual hand machines are the ratchet-drill and the breast-drill. Power drills have the axis of the drill fixed, vertical or horizontal, or the axis may be varied in position, as in radial drills; or in both position and angle, as in universal drills. A drill is distinguished from a boring machine in that it opens a hole in the solid by cutting at its end; to bore is to enlarge or true up a hole which already exists.

Drill, DIAMOND. Rock-drill in which the cutting tool consists of a hollow cylinder of steel, in the front end of which the borts are set in such a manner that they project both on the inside and outside of the crown, so that in cutting it leaves good clearance for the drill-bar, which is also hollow, allowing the core left by the crown to pass freely along the bar. The core is broken off with a wedge and removed. Water is forced into the inside of the drill-bar, which washes out the fine particles produced by the cut and keeps the diamonds cool. The drill has a circular motion. The wear of the diamonds has been found to be insignificant compared with the work they do. Stones after having cut a hole ¼-mile in length have retained much of their original value. Used largely for prospecting purposes. The core oftentimes shows the exact condition of the bed examined, but is often pulverized and hence of no value. The cost is much greater for deep holes by this method than by the long-rope method as practiced in the oil regions.

Drill, GRAIN. A machine for sowing and covering, in one operation, the seeds of the small grains, wheat, oats, barley, etc. It consists of a series of hollow tubes shod with a cultivator-point and arranged side by side under a receptacle for the seed. A mechanism delivers the seed from the receptacle to



Wheat, seed, and manure Drills.

the tubes, through which it falls to the seed-bed prepared by the cultivator-points, and is covered by the dirt falling behind the points. Most drills have also attachments for sowing commercial fertilizers and grass seeds.

Drill, MILITARY. Instruction and practice undergone by soldiers and sailors.

Drilling. Act of boring holes in wood, metal, stone, etc. It is performed in different ways according to the kind of hole required and the material to be penetrated. See DRILL, DIAMOND and ROCK DRILLS.

Dripstone. Molding above an opening, whether arched or linteled. In late Gothic work, the dripstone over linteled openings is continued down the sides, and either stopped with an ornamental termination or connected with a molding along the wall.

Drisler, HENRY, LL.D., b. 1818. Prof. Columbia Coll. since 1845; editor of Greek lexicons and other text-books.

Driven Well. Hollow iron cylinder, pointed and perforated at the foot and driven into the earth to a depth less than 33 ft., the water being then raised by a suction pump; frequently used for the water supply of towns, as at Brooklyn, N. Y.

Drive-Pipe. In well-boring, pipe, larger than the bore-hole is to be, rammed down through the surface material before the boring proper begins.

Drizzle. Small drops of rain falling slowly, usually from fog or low clouds; often merely a form of heavy, thick fog.

Drogheda. Seaport town of Ireland on the Boyne, 25 m. n. of Dublin; defended against O'Neill 1641-42; stormed by Cromwell Sept. 1649, and the garrison (3,000) massacred; surrendered to William III. July 13, 1690. Pop., 1891, 11,812.

Drölling, MICHEL MARTIN, 1786-1851. French painter.

Dromæognathæ. See TINAMOUS.

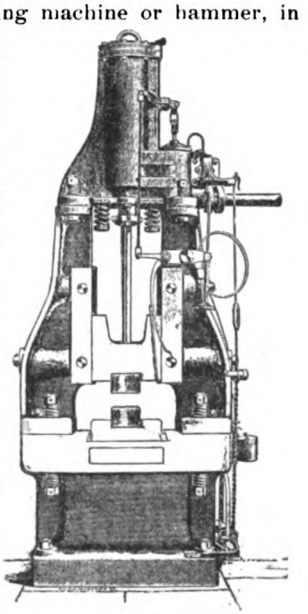
Dromatherium. Lower jaw of an insectivorous Marsupial, related to the Banded Ant-eater of Australia; found by Emmons ab. 1845 in red sandstones of N. C., generally regarded as Triassic; oldest mammalian fossil in America.

Dromedary. See TYLOPA.

Dromoscope. Apparatus or method of exhibiting the circulation of winds around a storm center, or for locating a storm center when the direction of the wind is known; specifically, instruments devised by Roux, Burian, Bouquet, and De la Grye.

Drop Cut-off. Form of valve-gear for producing an abrupt stop of the admission of steam to an engine-cylinder, by releasing the admission valve so that it closes by gravity. The Corliss and Sickles cut-offs are of this type. The valve is pushed open by the suitable rod, but at the proper time a latch is tripped by which the valve is released from connection with the rod, and a weight or spring shuts the valve quickly, while the rod completes its slower stroke. DASH POTS (q.v.) are usually provided for valves of this type.

Drop Press. Form of forging machine or hammer, in which a ram or monkey sliding uetween guides is raised to a height and is released to drop bpon the work on the anvil. The weight is lifted by two rollers at the top of the machine which seize on an oak plank secured to its top side. Provision is made to have the ram rise to the same height before being released, or else to deliver a succession of blows without readjustment. The control is by a foot-treadle, leaving the hands free for the work. This form of tool is specially adapted for forging in dies to produce complex shapes, as in gun and sewing-machine manufacture. One half the shape is on the anvil and the other half is on the bottom of the ram.



Drop Press.

Drop Seed Grass. Delicate grasses of the genera *Muhlenbergia* and *Sporobalus*, natives of America, widely distributed.

Dropsy. Collection of watery fluid in cavities or tissues of the body, due usually to disease of the heart, liver or kidneys. It may be caused by pressure of any kind upon the large veins of a part, as in pregnancy, in which the enlarged uterus presses on the veins of the legs.

Drop the Handkerchief. Child's game in which the players stand in a ring, and one of them runs around with a handkerchief and drops it. The child behind whom it is dropped chases the dropper. The one who gets home first takes the vacant place, and the other drops the handkerchief again.

Drop Timbers. Timbers for closing an opening through which water is flowing, by dropping them suddenly into position across the opening.

Droschky. Russian carriage, low, open, and four-wheeled.

Droseraceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising six genera and ab. 110 species, growing in the temperate and tropical regions, except in the Pacific Islands; called the Sundew family.

Droste-Hülshoff, ANNETTE ELISABETH, 1798–1848. German lyric poet.

Droste zu Vischering, CLEMENS AUGUST V., BARON, 1773–1845. Abp. of Cologne 1835; involved in difficulties with the government and imprisoned 1837–41.

Drouet, JEAN BAPTISTE, 1765–1844. French general; distinguished at Ulm, Hohenlinden, and Jena; created Count d'Erlon 1815 for seizing and holding Lille for Napoleon on his return from Elba; blamed for delays which contributed to the defeat of Waterloo; in Bavaria 1815–30; Gov.-gen. of Algeria 1834–35; marshal 1848.

Drouyn de Lhuys, EDOUARD, 1805–1881. French Minister of Foreign Affairs 1848, 1852–55, and 1862–66; Ambassador to London 1849.

Drown, THOMAS MESSENGER, M.D., LL.D., b. 1842. Prof. Chemistry in Lafayette Coll. 1874–81, and Mass. Institute of Technology 1885–95; State Chemist, Mass. Pres. Lehigh Univ. 1895.

Drowning. Asphyxiation by submersion in water for varying period, the length of which differs greatly. Persons have been under water for five minutes or even more and been restored to consciousness. In resuscitating, clothing above waist should be immediately removed, the person placed upon face, with something beneath the stomach to raise it a little higher than the mouth, to allow of escape of water from mouth and throat, moderate pressure being exerted upon back. Rolling person upon a barrel is often practiced, but it is objectionable. Next the person should be turned on back with something beneath to raise the lower part of the chest higher than the rest of the body. The operator, straddling the person, should place his hands upon each side of the lower ribs and by a quick movement push the chest upward and after a few seconds let it go suddenly, thus imitating the natural respiratory movements. This should be repeated about five times a minute to begin with and about three times as often when the person shows signs of recovery. If possible the arms should be straight above head and tongue drawn out of the corner of the mouth by aid of a cloth around it. It is better to begin operations the instant the person is removed from water and not to attempt to carry him under shelter. Stimulants should not be given until breathing begins to be resumed, except that the lips may be moistened with them. As soon as consciousness is fairly well established the person should be put into bed and kept warm for several hours. Efforts for resuscitation should be kept up for at least two hours.

Droysen, JOHANN GUSTAV, 1808–1884. Prof. at Kiel and Jena, and at Berlin from 1859; translator of Æschylus and Aristophanes. *Hist. Alexander the Great*, 1833; *Hellenism*, 1836.

Droz, ANTOINE GUSTAVE, 1832–1895. French novelist, noted for his sardonic wit. *Monsieur, Madame, et Bebé*, 1866; *Entre Nous*, 1867; *Les Étangs*, 1876; *L'Enfant*, 1885.

Druids. Priests of Celtic paganism in Britain and Gaul; a mysterious and powerful hierarchy, dwelling especially in forests and teaching a doctrine and worship sublime and morally pure, but gloomy and cruel; suppressed by the Romans before 100. They had three classes, bards, prophets, and priests; were teachers of youth and ministers of justice; had one chief, chosen for life; were exempt from military service and all public burdens. Persons under their interdict were deprived of civil rights. They regarded the oak and the mistletoe growing on it as sacred, and taught the transmigration of souls.

Druids, ORDER OF. Social and benevolent secret organization in England, Australia, and U. S.; founded in London 1781. The first lodge or "grove" in the U. S. was formed in N. Y. 1839. The several branches have ab. 120,000 members, including ab. 14,700 in America.

Drum. Most universal and primitive of musical instruments, and chief percussion agencies in the modern band. It consists of a membrane tightly stretched over one or both ends of a cylindrical vessel which acts as a resonating body. Side-drums have cords of catgut stretched across the lower membrane, which rattle against it when the head is struck. In funeral marches a solemn effect is produced by muffling these snares. The bass drum has no snares, is much larger, and is played on with a stick having a ball of soft material at the end. The most musical members of the drum family, since they have pitch, are the kettle-drums, commonly used in pairs, and called by musicians tympani. They are hemispherical brass or copper vessels, covered with vellum heads. The pitch depends on the tension of the head, applied generally by key-screws working through the ring that holds the vellum. Kettle-drums are

Egyptian and Assyrian Drums.

usually tuned to the key note and fifth of the scale in which the music is set.

Drum. 1. In machinery for hoisting, cylinder or cone on which the cable is wound. 2. Trommel, prismatic, cylindrical, or conical, revolving sizing and washing apparatus, used in ore-dressing and in preparing coal for market.

Drumclog. Moor in w. Scotland, where Claverhouse was defeated by the Covenanters, June 11, 1679.

Drum Fish. *Pogonias chromis.* It has barbels below the lower jaw. It lives in salt water and occasionally comes in schools to planted oyster beds, where it destroys all the shell-fish, seeming to delight in chewing them to pieces without eating them. It is a large fish, ranging from 20 to 100 lbs. The drumming sound it makes is due to the grinding of the pharyngeal bones, or teeth, on each other. The River Drum-fish has no barbels. In southern waters lives the Red-fish (*Sciœna*), of the same family as *Pogonias*. This has no barbels, but has a band of dark color near the tail and makes a drumming sound, whence it is distinguished as the Banded Drum. See ACANTHOPTERI.

Drum-Head Court-Martial. One summoned by the commanding general of an army and convened to try offenses committed on the march which demand an immediate example for the improvement of discipline; not resorted to in time of peace.

Drumlin. Name given by Irish geologists to long and narrow mounds of drift material, believed to be due to glacial agencies. See ESKER.

Drum Major. Non-commissioned officer, generally a sergeant, who directs the movements of the band when marching also charged with the instruction of the drummers.

Drummers, or COMMERCIAL TRAVELERS. Agents who exhibit samples of goods and solicit and take orders therefor, which are filled by their principals; are not peddlers or merchants. A State tax upon drummers from other States is unconstitutional as a restriction upon interstate commerce. Their powers and duties are governed by the law of agency.

Drumming Out. Ceremony of ignominious discharge from the service. The culprit is marched out of the garrison at the point of the bayonet, the drummer playing the Rogue's March.

Drummond, HENRY, LL.D., b. 1851. Scottish author; prof. in Free Ch. Coll., Glasgow, from 1877. *Natural Law in the Spiritual World*, 1883; *Tropical Africa*, 1888; *The Greatest Thing in the World*, 1890; *Ascent of Man*, 1894.

Drummond, THOMAS, 1797–1840. Scottish military engineer, inventor of the Drummond Light.

Drummond, WILLIAM, OF HAWTHORNDEN, 1585–1649. Scottish poet; visited by Ben Jonson, 1619. *Forth Feasting*, 1617; *Flowers of Zion*, 1623.

Drummond Light, LIME LIGHT, or CALCIUM LIGHT. Source of light much used in theaters, consisting of a piece of lime heated to incandescence by the oxyhydrogen flame.

Drunkenness. See ALCOHOLISM.

Drupe. Stone fruit, as the cherry, apricot and peach, consisting of a hard pit or endocarp surrounded by a fleshy mesocarp, and this covered with a thin exocarp.

Drupelet. Individual carpels of aggregate fruits, as the blackberry.

Drury College. At Springfield, Mo.; chartered 1873;

maintained by Congregationalists. It has 14 instructors, 80 students of college grade, with a total of 372, and a library of 21,000 vols.

Druse. Hollow cavity in a mineral vein, lined with crystals; a vug.

Druses. Syrian tribe and sect, mostly settled on Southern Lebanon, and in Hauran, numbering ab. 85,000. Their religion is defined by Brockhaus as a mixture of Moslem Gnosticism with Christian ideas and relics of native worship. They appear to be Mohammedans, and do not initiate even the bulk of their own people, but hold to successive incarnations, the last in Hakim, caliph 1019-44. Their founder was Ismail Darasi, who settled in the Lebanon 1040.

Drusilla, d. 79. Daughter of Herod Agrippa. Abandoning her husband, Prince Azizus, she married Felix, procurator of Judæa. St. Paul preached before them. She perished at the destruction of Pompeii.

Drusus, NERO CLAUDIUS, 38 B.C.–A.D. 9. Roman general; son of Tiberius Nero by Livia; third wife of Augustus; adopted by Augustus; named Germanicus for his four campaigns in Germany, by which the Roman sway was extended to the Elbe and the Northern Ocean.

Drusus.

Drusus, MARCUS LIVIUS. Father and son, tribunes 122 and 91 B.C.

Dryads. See NYMPHS.

Dry-Bone. Ores of zinc, the carbonate and the silicate occurring in forms resembling bone.

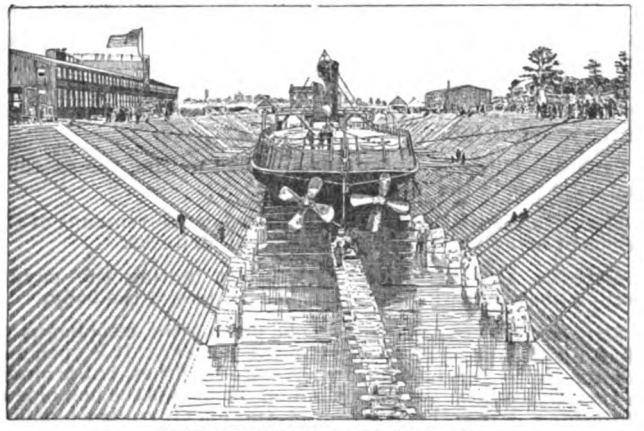
Dryburgh. Abbey in Scotland, near Melrose; founded 1150, ruined 1544–45; burial-place of Scott and Lockhart.

Dry-Coal. Containing little hydrogen.

Dry Closet. Arrangement, often portable, in which earth or any dry absorbent substances receive the excreta; used only where water is not available. See EARTH CLOSET.

Dryden, JOHN, 1631–1700. English poet and dramatist, called "Glorious John"; poet-laureate 1668; translator of Virgil 1696. His 27 plays, 1662–1694, are too often gross, after the manner of the time. His best work is in *Annus Mirabilis*, 1667; *Absalom and Achitophel*, a political satire, 1681; *Religio Laici; The Hind and the Panther*, 1687, defending the R. C. Ch.; and the odes for St. Cecilia's Day. His prose *Essay on Dramatic Poesy*, 1660, is of value.

Dry Dock. Basin for the repair of vessels, the water being pumped out after the vessel has entered and been secured by lateral shoring. At the Navy Yard in Brooklyn, N.Y., are two large dry docks, one of granite, which is 320 feet long and cost $2,241,000, and the other of timber, which is 530 feet long and cost $566,000. The pumps for the latter have a capacity of


Graving Dock at Hampton Roads, Va.

80,000 gallons per minute, and can empty it in 90 minutes. Other large dry docks in the U. S. are those at Portsmouth, Va., and League Island, Pa.

Dry Dressing, or DRY SEPARATION. Process of concentrating or cleaning ore or coal without the use of water.

Drying Oils. Vegetable and animal oils which easily absorb oxygen from the air, and which, if exposed to the air in a thin film, soon become gummy and later turn to a solid; *e.g.*, linseed oil, menhaden oil.

Dryolestes. Small extinct opossum from the American Jurassic.

Dry Piles. Apparatus for showing the difference of potential produced by the contact of heterogeneous metals. They are of various kinds. In Zamboni's pile, *e.g.*, very many disks of paper are cut and coated on one side with tin or silver, and on the other with peroxide of manganese; 1,200 or 1,500 of these are placed in a glass tube with their similar faces all turned the same way. The ends of the pile are connected with brass knobs, that connected with the manganese being positive. Dry piles are remarkable for the permanence of their action.

Dry Point. Sharp etching-needle used to incise fine lines on the copper, without the plate being covered with etching ground or the lines being bit in by acid. The work thus produced is very delicate and wears better than the acid bitten lines.

Dry Rot. Fungus which, penetrating wood by its mycelium, causes it to decay; it is the *Merulius lacrymans*, and occurs in unseasoned timber when in a dry place where is little circulation of air.

Dry Tortugas. Small islands off s.w. coast of Florida, with two lighthouses; used as a military prison 1861–65.

Dualin. Explosive containing ab. 50 per cent of nitroglycerine, 30 of sawdust, and 20 of saltpeter; used in blasting.

Dualism. Philosophic theory that there are two independent substances or realities, absolutely opposed to each other in their attributes, one being characterized by extension and material properties, and the other by consciousness and spiritual properties. It was most conspicuous in GNOSTICISM and ZOROASTRIANISM (q.v.), and opposed to the good Principle or Deity, an evil one, destined to be finally subdued.

Duat. National game of Siam, resembling backgammon, played upon a board by two persons, with cowrie shells as men, according to the throws with five cowries. The latter are thrown from a tube like a dice box into a cylinder that stands in the center of the board, the middle of which is covered with moist clay, upon which the cowries fall.

Du Barry, MARIE JEANNE, GOMARD DE VAUBERNIER, COUNTESS, 1746–1793. Mistress of Louis XV., over whom she held absolute sway from 1769; banished 1774; guillotined.

Du Bartas, GUILLAUME SALLUSTE, 1544–1590. French poet. His best work is *The Week* (of Creation), this and his *Second Week*, poems of vast length, were tr. by J. Sylvester 1598. He was a Huguenot, and received a mortal wound at Ivry.

Dublin. Capital and principal city of Ireland, at the head of D. Bay. It is irregularly laid out and ill drained, but contains many beautiful streets, parks, public buildings, and pri-

Sackville Street, Dublin.

vate residences, and is the site of several colleges of literature and science. It was taken in 9th century by Danes, who were driven out 1170. Henry II. of England held court here 1171. It was besieged unsuccessfully 1646 by an Irish army of 16,000 foot and 1,600 horse under direction of the Pope's nuncio. Here Cromwell landed with a large force 1640, and James II. held a parliament 1689. Pop., 1891, 254,709.

Dublin, R. C. UNIVERSITY OF. Organized in 1854. It has five faculties and no endowments.

Dublin, UNIVERSITY OF. Trinity Coll., founded in 1320, and again 1592. It has an annual income of ab. £65,000, a library of 200,000 vols., an astronomical and a magnetic observatory, special departments of medicine, theology, and engineering, and ab. 1,300 students. Religious tests were abolished 1873.

Dübner, FRIEDRICH. 1802–1867. German-French scholar, ed. of Didot's *Bibliotheca Græca*, and of sundry classics.

Du Bois, AUGUSTUS JAY, Ph.D., b. 1849. Prof. of Civil Engineering Lehigh Univ. 1875–77; Yale since 1877. *Graphic Statics*, 1875; *Framed Structures*, 1890.

Dubois, CLEMENT FRANCOIS THEODORE, b. 1837. Organist of the Madeleine in Paris since 1877; composer.

Dubois, GUILLAUME, 1656–1723. Minister of the French Regent from 1715; Abp. of Cambrai 1720, Cardinal 1721; Premier 1722. He formed the Triple Alliance with England and Holland 1717.

Dubois, PAUL, b. 1829. French sculptor and painter.

Duboisine. Alkaloid obtained from *Duboisia myoporoides*, a sæpiglossideous Australian shrub, having the same effects as atropine, but more powerful.

Du Bois-Reymond, EMIL, b. 1818. Prof. Physiology Berlin from 1858; most eminent for studies in animal electricity.

Dubs, JAKOB, 1822–1879. Pres. Helvetic Confederation 1864 and 1870. *Swiss Democracy*, 1866.

Dubufe, CLAUDE MARIE, 1790–1864. French painter.—His son EDOUARD, 1820–1883, was noted for decorative work.—His grandson, EDOUARD MARIE GUILLAUME, b. 1853, painted the ceiling of the foyer in the Theâtre Français.

Dubuque. City of Dubuque co., Iowa, on Miss.; oldest settlement in the State, made 1833; previously occupied by lead miners, 1788–1810. It is a center of boating and railways, and has several colleges and seminaries. Pop., 1890, 30,311.

Duc, JOSEPH LOUIS, 1802–1879. Architect of the Paris Palais de Justice.

Ducamp, MAXIME, b. 1822. French poet, novelist, and descriptive writer. *Paris*, 6 v., 1875; *Convulsions of Paris*, 1879.

Du Cange, CHARLES DU FRESNE, 1610–1688. French author of a *History of Constantinople*, 1657, and of *Glossaries of Greek and Latin Writers*, 5 vols., 1678–88, extended by other hands and still valued.

Ducas, MICHAEL, d. ab. 1470. Greek historian of the fall of the Byzantine empire.

Ducasse, JEAN BAPTISTE, ab. 1640–1715. Gov. of St. Domingo 1691–1703; general and admiral in the Spanish war.

Ducat. Gold coin of mediæval Italy and of Germany from 1559; usual value ab. $2.25. Also, modern silver coins of several countries and differing values.

Duccio. Ab. 1300. Italian painter of Siena, representing, like Cimabue, a break with the Byzantine style which he did not, however, entirely abandon. His greatest surviving work is the altar-piece in the Siena Cathedral.

Du Chaillu, PAUL BELLONI, b. 1835 in Paris. American explorer and author. His *Equatorial Africa*, 1861, first made the gorilla generally known. *Ashango Land*, 1867; *Country of the Dwarfs*, 1872; *Land of the Midnight Sun*, 1881; *Age of the Vikings*, 1889.

Duchesne, ANDRE, 1584–1640. French historian and bibliographer. His account of historians of the Franks, 1636–49, continued by his son FRANCOIS, 1616–1693, fills 5 vols.

Duchoborzi. Mystical Russian sect, founded in 18th century; settled in Transcaucasia 1841.

Ducis, JEAN FRANCOIS, 1733–1816. French poet, dramatist, and translator of Shakespeare.

Duck. See ANATINÆ, EIDERS, LABRADOR DUCK, MALLARD DUCKS, MERGANSERS, SHELLDRAKES, and TREE DUCKS.

Ducking Stool. Plunging in water was a punishment among the ancient Germans and Franks for people of scandalous lives, and was common at Marseilles and Bordeaux till the Revolution. In England it occurs as a correction for common scolds. It is mentioned in Domesday Book, and lasted till the present century.

Ducking Stool.

Duck Mole. See ORNITHORHYNCHUS.

Duck on the Rock. Boys' game in America, derived from England. Each boy has a stone called a duck. A large stone called the duckstone is placed on the ground and a place near it is chosen for "home." One of the players puts his stone on the duckstone, and the others throw their ducks in turn and endeavor to knock it off. As each throws, he runs up to his stone and watches his chance to carry it back to the "home." If the one whose duck is on the rock can catch any of the others while carrying back his stone before reaching the line, the one caught must take the catcher's place, but if the duck is knocked off the rock, its owner must replace it before he can touch any one.

Ducks and Drakes. Pastime in which flat stones or slates are thrown upon the surface of a piece of water, so that they may dip and emerge several times without sinking.

Duckweed. Species of the genus *Lemna*, minute floating plants of the natural family *Lemnaceæ*, of wide geographical distribution. Also called Duck's-meat.

Duclerc, CHARLES THEODORE EUGENE, 1812–1888. French journalist; Deputy 1871, Life Senator 1875, Prime Minister 1882–83.

Duclos, CHARLES PINEAU, 1704–1772. French historian, novelist, and essayist. *Manners of the Century*, 1750; *Secret Memoirs of the Reign of Louis XIV. and XV.*, 1791.

Du Couret. See ABD-EL-HAMID.

Du Crot, AUGUSTE ALEXANDRE, 1817–1882. French general and author. *Defense of Paris*, 4 vols., 1875–78.

Duct. Canal or passage transporting the secretion of a gland.

Ductility. That specific property of matter by virtue of which it can be drawn out into thread or fine wire. The order of ductility for the metals is, according to Daniell, gold, silver, platinum, iron, copper, palladium, aluminium, zinc, tin, lead. Wollaston obtained a platinum wire 0.00003 of an inch in diameter, by first coating the wire with a comparatively thick layer of silver; after this was drawn as fine as possible the silver was dissolved off, leaving the platinum. Cast iron has no ductility, while wrought iron and some varieties of steel possess the property in a high degree.

Ducts. Large vessels occurring in the woody portions of plants, forming part of the prosenchymous tissue; also known as Trachaæ and Canals.

Ductus Arteriosus, or BOTALLI. Remnant of the artery which connects the dorsal ends of the third or fourth aortic arches of the embryo in Reptiles, and the fourth and fifth arches in Mammals (between the aorta and pulmonary arteries).

Ductus Cuvieri. Short vein that receives the blood from the cardinals on each side and conveys it to the sinus venosus of the heart of fishes.

Ductus Endolymphaticus. Duct uniting the sacculus and utriculus in the inner ear.

Ductus Kœllikeri. Small ciliated canal, remnant of the orifice of invagination of the otic sacs of Mollusks.

Ductus Perilymphaticus. Duct uniting the cavum perilymphaticum with the lymphatic system of the body.

Ductus Pneumaticus. Tube uniting the œsophagus or pharynx of fishes with the swimming bladder. It is open and admits air to this bladder, in physostome fishes, but is closed in the *Physoclisti*. As the swimming bladder is the homologue of the lung, in the other *Vertebrata*, this duct is really a modified primitive trachea.

Ductus Venosus, or OMPHALO-MESENTERIC VEIN. United vitelline and mesenteric veins as they pass through the liver in the embryo. It atrophies in Sauropsida as the venæ advehentes and revehentes develop. In Mammals it persists as the ductus venosus of Arantius.

Du Deffand, MARIE DE VICHY-CHAMROND, MARQUISE, 1697–1780. French writer, noted for her *Letters*. She was the correspondent of most of the men of letters in her day.

Dudevant, MME. AMANTINE LUCILE AURORE, *née* DUPIN ("GEORGE SAND"), 1804–1876. French novelist, of high rank and great fertility. Her first books, *Rose and Blanche*, *Indiana*, and *Valentine*, appeared 1832; among the best are *André*, 1835;

Spiridion, 1839; and the famous *Consuelo*, 1842. She wrote also plays, essays, political articles, and several volumes of travel

Madame Dudevant.

and autobiography, as *Histoire de ma Vie*, 1854. Her *Correspondence*, 1881–84, filled 6 vols.

Dudley. Borough of England, 8 miles w.n.w. of Birmingham. It has large manufactures of iron. Pop., 1891, 45,740.

Dudley, BENJAMIN WINSLOW, M.D., LL.D., 1785–1870. Surgeon, in Lexington, Ky., from 1814; famous as a lithotomist.

Dudley, EDMUND, ab. 1462–1510. Extortionate minister of Henry VII.; executed by Henry VIII.—His son JOHN became Earl of Northumberland 1551.

Dudley, HENRY BATE, 1745–1824. English dramatist; founder of the London *Post*, 1775, and *Herald*, 1780.

Dudley, ROBERT. See LEICESTER.

Dudley, THOMAS, 1576–1652. Deputy-gov. of Mass. 1630; Gov. 1634, 1640, 1645, 1650.—His son, JOSEPH, 1647–1720, was Chief-justice 1686, and Gov. 1702–15.—Joseph's son, PAUL, F.R.S., 1675–1751, became Atty.-gen. 1702, Judge 1718, and Chief-justice 1745.

Duel. Ancient form of trial; combat with deadly weapons pursuant to a previous agreement. It is a crime generally by modern statutes, and in some States disqualifies for office. The

Trial by Combat (from MS. 15th century).

practice was long supported by public opinion, and beyond Great Britain and the U. S. is still generally permitted, under occasional restrictions.

Duenna. Head lady-in-waiting of the Queen of Spain, known also as Camérera Mayor: in English, Mother of the Maids. Duenna also means generally a woman's female guardian or chaperon.

Due Process of Law. Course of legal proceedings, according to those rules and forms which have been constitutionally established for the protection of private rights.

Duer, JOHN, LL.D., 1782–1858. Judge of N.Y. Superior Ct. 1849–58. *Law and Practice of Marine Insurance*, 1845; *Reports of Superior Ct.*, 6 vols., 1854–58.—His brother, WILLIAM ALEXANDER, LL.D., 1780–1858, was Judge of N. Y. Supreme Court 1822–29, and Pres. Columbia Coll. 1829–42. *Constitutional Jurisprudence*, 1833–56.

Dufaure, JULES ARMAND STANISLAS, 1798–1881. French lawyer; Deputy 1834, Minister of the Interior 1849, and of Justice 1871.

Du Fay, CHARLES FRANCOIS DE CISTERNAY, 1698–1739. French chemist and electrician.

Du Fay's Law. Qualitative law of electrical attraction and repulsion: "Bodies similarly electrified repel one another; bodies oppositely electrified attract one another."

Duff, ALEXANDER, D.D., LL.D., 1806–1878. Scottish missionary and educator in Calcutta 1830–63.

Dufferin and Ava, FREDERICK TEMPLE HAMILTON BLACKWOOD, MARQUIS OF, LL.D., D.C.L., b. 1826. Under Sec. for India 1864–66, for War 1866; Gov.-gen. of Canada 1872–78; Ambassador to Russia 1879–81, to Turkey 1881–84; Viceroy of India 1884–88; Marquis 1888; Ambassador to Italy 1888–91, to France 1891. *Letters from High Latitudes*, 1859; *State of Ireland*, 1866.—His wife GEORGINA ROWAN HAMILTON, m. 1862, has pub. *Viceregal Life in India*, 1889, and *Canadian Journal*, 1891.—His mother, HELEN SELINA SHERIDAN, COUNTESS GIFFORD, 1807–1867, wrote songs.

Duffield, GEORGE, D.D., 1732–1790. Missionary in Pa., and father of a line of Presbyterian ministers.—His great-grandson, GEORGE, D.D., 1818–1888, wrote hymns and was father of SAMUEL AUGUSTUS WILLOUGHBY, 1843–1887, author of *Warp and Woof* (verse), 1870; *English Hymns*, 1886; and *Latin Hymn-writers*, 1889.

Duffy, SIR CHARLES GAVAN, b. 1816. Irish leader; ed. Dublin *Nation*; tried 1844 and 1848; M.P. 1852; in Australia from 1856; Prime Minister of Victoria 1871; knighted 1873. *Ballad Poetry of Ireland*, 1850; *Young Ireland*, 1880; *Irish History*, 1845–49, 1883.

Dufour, GUILLAUME HENRI, 1787–1875. Swiss general. *Fortification*, 1824; *Tactics*, 1840.

Dufrenite. $Fe_4P_2O_{11}+3aq$. Hydrous iron phosphate of greenish color, altering to a yellow or brown on exposure.

Dufrénoy, PIERRE ARMAND, 1792–1857. French geologist and mineralogist. *Traité complet de mineralogie*, 1845.

Dufrenoysite. $2PbS+2As_2S_3$. Swiss mineral containing sulphur, arsenic, and lead.

Dugdale, SIR WILLIAM, 1605–1686. English antiquarian; knighted 1677. *Warwickshire*, 1656; *Monasticon Anglicanum* (with R. Dodsworth), 1655–73; *Baronage*, 1675–76.

Dughet, GASPARD, 1613–1675. Italian landscape painter; relative of POUSSIN (q.v.), whose name he assumed.

Dugong. See SIRENIA.

Duguay-Trouin, RENE, 1673–1736. French privateer and naval commander, renowned chiefly for the capture of Rio Janeiro 1711.

Du Guesclin, BERTRAND, ab. 1314–1380. French general, eminent in wars with the English, who captured him 1367. His chief successes were as Constable, from 1369.

Du Hamel du Monceau, HENRI LOUIS, 1700–1782. French agriculturist and botanist. *Traité des arbres frutiers*, 1768–1782; *La physique des arbres*, 1758; *Traité des arbres et arbustes*, 1755.

Duhamel, JEAN MARIE CONSTANT, 1797–1872. French mathematician; Prof. Paris. *Course of Analysis*, 1842; *Calculus*.

Duilius. Consul 260 B.C. He gained for Rome her first naval victory over Carthage by use of grappling irons.

Duisburg. City of Prussia, 15 m. n. of Dusseldorf; once a Hanse town and a free city of the empire. It has manufactures of iron, cotton, and woolen goods. Pop., 1890, 59,285.

Dujardin, FELIX, 1801–1860. French biologist, noted for his researches concerning protoplasm.

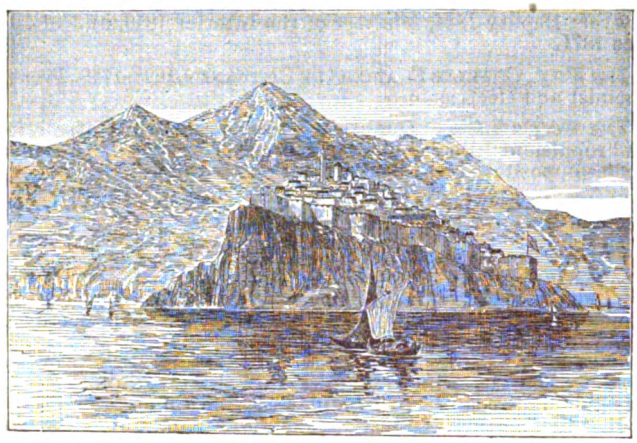
Dujardin, KAREL, ab. 1640–1678. Dutch painter.

Duke. Originally, military governor of a province; in mediæval and modern times, title of varying dignity in different countries; often bestowed on royal princes; introduced in England 1337.

Dulce Domum. Latin song at Winchester Coll. since ab. 1690; sung before leaving for the long vacation.

Dulce y Garay, DOMINGO, MARQUIS OF CASTELL-FLORIT, 1808–1869. Spanish officer, in 1862–66 and '69 Captain-gen. of Cuba, where he suppressed the slave-trade.

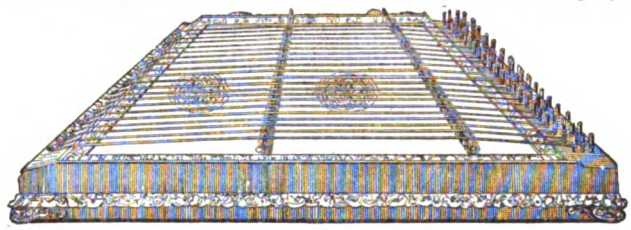
Dulcigno. Seaport of Montenegro, on the Adriatic; taken by the Turks 1571; long a den of pirates; scene of a defeat of



Dulcigno, from the North.

Venetians by Turks, Aug. 4, 1718; stormed by Montenegrins 1878, and ceded to them by Turkey 1880. Pop. ab. 5,000.

Dulcimer. Musical instrument consisting of a wooden frame, generally trapeze-shaped, covered with a sounding board bearing bridges, and strung with wires which are played



Dulcimer.

upon with small sticks or hammers held in the hands. Once universally popular, it is now seldom heard in America outside of a Hungarian band. It was a direct precursor of the pianoforte.

Dulcite. $C_6H_8(OH)_6$. Melampyrin. An alcohol possessing saccharine characteristics, found widely distributed in the vegetable kingdom. Large colorless prisms with sweet taste. Isomeric with MANNITE (q.v.).

Dulia. In R. C. theology, reverence allowed to glorified saints, as intercessors with God, but not themselves sources of grace.

Dulong, PIERRE LOUIS, 1785–1838. French chemist and physicist. Director Polytechnic School, Paris.

Dulong and Petit's Law (OF ATOMIC HEAT). The specific heat of an element is inversely proportional to its atomic weight, or the product of the specific heat and the atomic weight is equal to a constant. This constant is called atomic heat; it is approximately equal to 6.4. If we take as many grams of any element as are numerically equal to its atomic weight, and call this amount a gram-atom, the atomic heat of the element is the number of calories of heat necessary to raise the temperature of one gram-atom 1° C. In the case of compounds, we speak of the molecular heat, which is approximately equal to the sum of the atomic heats of the component elements. The above law when applied to compounds is known as "Naumann's Law."

Dulong and Petit's Law (OF COOLING). In an undisturbed atmosphere the law of cooling by convection is that the rate of cooling is proportional to $pat^{1.233}$, where a is a constant (0.45 for air), p the pressure, and t the excess of temperature. In hydrogen the process is very rapid, *i.e.*, a is large.

Dulse. Common red sea-weed, eaten as a vegetable in parts of Europe and New England. *Rhodomenia palmata.*

Duluth. City of St. Louis co., Minn., at the head of Lake Superior. It has unusual facilities for lake navigation. Its growth is since 1869. Pop., 1890, 33,115.

Dulwich Gallery. Near London. It contains ab. 350 pictures and is especially rich in good examples of the Dutch Masters, as Cuyp and Wouverman.

Dumas, ALEXANDRE, 1806–1870. French romancer and dramatist; son of a general; grandson of a nobleman and a Haitian negress. His habits were loose and prodigal, but his genius is beyond question. His most famous works are *Monte Cristo*, 1841–45, and *Three Guardsmen*, 1844–45. Many of his novels are in part the work of other hands. His series of Napoleonic tales was tr. 1894.

Dumas, ALEXANDRE, FILS, 1824–1895; son of the last. French dramatist, whose plays profess a social or ethical aim; Academician 1875. His novel *La Dameaux Camelias*, 1848, was dramatized 1852. Among his works are *The Demimonde*, 1855; *The Natural Son*, 1856; *Mme. Aubray*, 1867; *M. Alphonse*, 1873; *Denise*, 1885.

Dumas, JEAN BAPTISTE ANDRE, 1800–1884. French chemist. He discovered trichloracetic acid, and devised methods

Jean Baptiste Andre Dumas.

for the determination of nitrogen and of vapor densities, which are still in use. *Traité de chimie appliquée aux Arts; Leçons sur la Philosophie Chimique.*

Du Maurier, GEORGE LOUIS, b. 1834. English artist and novelist, long afflicted with weak eyes, but famous for his pictures in *Punch*, and of late for two brilliant tales, *Peter Ibbetson*, 1891, and *Trilby*, 1894.

Dumb Drift. See DRIFT.

Dumbness. Absence of power of speech. May be due to paralysis of muscles of larynx, disease of brain, idiocy, or be an accompaniment of deafness in early life, the person being unable to acquire the faculty on account of inability to hear the voices of others.

Dumont, PIERRE ETIENNE LOUIS, 1759–1829. Swiss editor and translator of Bentham's works on legislation; resident mainly in England till 1814. *Souvenirs sur Mirabeau*, 1832.

Dumont d'Urville, JULES SEBASTIEN CESAR, 1790–1842. French naval officer, who conducted explorations in the s. Pacific 1826–29, and in the Antarctic regions 1837–40; author of many vols. of *Voyages.*

Dumortier, BARTHELEMY CHARLES, 1797–1878. Belgian naturalist. *Florula Belgica*, 1827; *Structure comparée et le développement des animaux et des vegetaux*, 1832; *Sylloge Jungermannidearum Europæ indigenarum*, 1831.

Dumose. In form resembling a low bush.

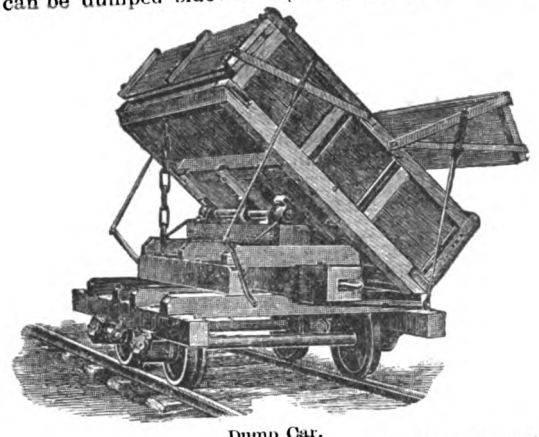
Dumoulin, CHARLES, 1500–1566. Huguenot lawyer of wandering and persecuted life, who wrote on the abuses of the Roman curia, 1552, and on the Council of Trent, 1564. His books, being prohibited, were pub. in Italy with the name of Gasper Caballinus.

Dumoulin, or **Molinceus,** PIERRE, D.D., 1568–1658. Fr. Calvinist; prof. at Sedan 1621. *Buckler of the Faith*, 1617, tr. 1620.

Dumouriez, CHARLES FRANÇOIS, 1739–1823. French general, who checked the advance of the Allies, defeated the Austrians at Jemmapes Nov. 6, 1792, and overran the Low Countries, but was defeated at Neerwinden March 18, 1793, accused of treason to the Convention, and ordered to return to Paris. He refused, became an exile, and died in England. *Memoirs*, 1794; *Life*, 1822–24.

Dump. Pile of waste rock that accumulates about a mine.

Dump Cars. Small cars for carrying earth, so arranged that it can be dumped sidewise upon the track or on an em-



Dump Car.

bankment. It is used in constructing and ballasting railroads, excavating and filling in, for carrying ores, etc.

Dumpy Level. Engineers' level having the bubble firmly attached to the vertical axis so that it cannot be reversed with respect thereto. It is mostly used in England and Canada; the Y level is used in the U. S.

Dünaburg. Fortified town of w. Russia, on the Dwina; of military importance. Pop. ab. 73,000.

Dunal, MICHEL FELIX, 1789–1856. Prof. Montpellier. *Solanorum generumque affinium Synopsis*, 1816; *Histoire naturelle, médicale et économique des Solanum*, 1813; *Organes de la fleur*, 1829.

Dunbar. Town of e. Scotland, where the Earl of Surrey defeated Baliol, April 27, 1296, and Cromwell gained a signal victory over the royalist Scots, Sept. 3, 1650. Pop., 1891, 3,545.

Dunbar, WILLIAM, ab.1460–ab.1520. Scottish poet. Mainly allegorical and satirical.

Duncan, ADAM, VISCOUNT, 1731–1804. British admiral 1789; commander of the North Sea fleet 1795. He won a victory over Dutch fleet near Camperdown, Oct. 11, 1797, and was made a peer.

Duncan, SARA JEANETTE (MRS. EVERARD COTES), b. 1863 in Canada, m. 1890, and resident in Calcutta. Author of *A Social Departure*, 1890; *An American Girl in London*, 1891; *Simple Adventures of a Memsahib*, 1893.

Duncan, THOMAS, 1807–1845. Scottish painter, chiefly of portraits.

Dunciad, THE. Poetical satire by A. Pope, 1728–42, in which he took revenge on his many enemies and critics.

Duncker, MAXIMILIAN WOLFGANG, 1811–1886. Prof. at Halle 1842 and Tubingen 1857; keeper of Prussian archives 1861–75. *History of Antiquity*, 1852, tr. 1877–82.

Duncombe, THOMAS SLINGSBY, 1797–1861. M.P. from 1826; author of sundry British reforms.

Dundas, HENRY, VISCOUNT MELVILLE, 1742–1811. Scottish M.P. 1774; Lord Advocate 1775; member of several cabinets; supporter of Lord North and the war with America, and later of Pitt; peer 1802; tried for malversation 1806, and acquitted. —His father, ROBERT, 1685–1753, Lord Advocate 1720–25, was an eminent lawyer and judge.

Dundee. City of e. Scotland, on the Firth of Tay; noted for its shipyards and manufacture of flax and jute. The castle

Entrance to Port of Dundee.

was taken by Wallace 1297, and razed by Bruce 1313. The city was burned by the Duke of Lancaster 1385, pillaged by the Marquis of Montrose 1645, and sacked by General Monk 1651. Its college was opened 1883. Pop., 1891, 155,640.

Dundee, VISCOUNT. See GRAHAM, JOHN.

Dundonald, EARL OF. See COCHRANE, THOMAS.

Dune. Sandhill on a coast formed by wind action; very common in n. w. Europe.

Dunedin. Ancient name of Edinburgh, often used by poets.

Dunedin. City of New Zealand, on the e. coast of South Island; founded 1848 by members of Free Ch. of Scotland. Pop., 1891, 45,865.

Dungeon. See DONJON.

Dunglison, ROBLEY, M.D., LL.D., 1798–1869. Prof. Jefferson Medical Col., Phila., 1836–68. *Dict. Medical Science*, 1833; *Therapeutics*, 1836.

Dunite. Highly basic crystalline rock without feldspar; a peridotite, consisting essentially of olivine and chromite; named from Mt. Dun in New Zealand.

Dunkers, TUNKERS, or DUNKARDS. Denomination of German Baptists, originating ab. 1708 in Westphalia. They emigrated to Pa. 1718 and later, are of simple and austere discipline, and number ab. 60,000.

Dunkirk. Seaport of n. France, formerly of Spanish Netherlands; taken by the English 1540, by French 1558, who restored it to Spain 1559; by Condé 1646, by Spaniards 1652, and by English 1658; sold by Charles II. 1662 to Louis XIV. for £200,000. Pop., 1891, 39,498.

Dunlap, WILLIAM, 1766–1839. American artist and dramatist; biographer of G. F. Cooke 1813, and C. B. Brown 1827. *American Theater*, 1832; *Arts of Design in U. S.*, 1834.

Dunmow. Town in Essex, England, famous for the tenure of the manor (made by Robert Fitz-Walter, 1244), "that whatever married couple will go to the Priory and, kneeling on two sharp-pointed stones, will swear that they have not quarreled nor repented of their marriage within a year and a day after its celebration, shall receive a flitch of bacon." There were only five claims from 1445 to 1855.

Dunnage. Billets and brushwood laid at the bottom of a ship's hold to keep the cargo above the bilge water, also sacking, etc., for wedging to prevent the cargo from shifting.

Dunois, JEAN, COMTE DE, "BASTARD OF ORLEANS," 1402–1468. National hero of France. He defended Orleans 1428–29, drove the English from Normandy and Guienne 1448–55, and joined the league of the nobles against Louis XI.

Dunoyer, BARTHELEMY CHARLES, 1786–1862. French economist. *Liberté du Travail*, 1845.

Dunsinane. Hill in Perthshire, Scotland, where Macbeth was defeated by Siward, Earl of Northumberland, 1054.

Duns Scotus, JOHANNES, ab. 1265–1308. One of the greatest schoolmen, *Doctor Subtilis*. He taught at Oxford and Paris, and founded the school of Scotists, who opposed the Thomists or followers of Aquinas.

Dunstable, or **Dunstaple,** JOHN, 15th century. English astrologer, mathematician, and musician, supposed inventor of counterpoint.

Dunstan, ST., ab. 925–988. Abp. of Canterbury 959. Under Edred, 946–955, and Edgar, 959–978, he had great power, and used it with eminent ability for good ends.

Dunwoody, HENRY HARRISON CHASE, b. 1842. Major in U. S. Signal Corps 1889; assistant in U. S. Weather Bureau 1891; pres. Association State Weather Services. *Weather Proverbs; Rainfall and Crops.*

Duodecimals. Numbers having a scale of 12.

Duodenum. Portion of the intestine immediately connected with the stomach; ab. nine inches long. The bile and pancreatic secretion are emptied into it. Inflammation of it is Duodenitis.

Dupanloup, FELIX ANTOINE PHILIBERT, 1802–1878. Bp. of Orleans 1849; member of the Academy 1849, and of the Assembly 1871. He was a Gallican, opposing papal infallibility and promoting free schools. *Education*, 3 v., 1855–57; *Christian Marriage*, 1868.

Duperrey, LOUIS ISIDORE, b. 1786. French explorer in the Pacific, 1822–25. *Voyage*, 1826–30.

Du Perron, JACQUES DAVY, 1559–1618. Bp. of Evreux 1595, Cardinal 1604, Abp. of Sens 1606; noted as a poet and controversialist. He bore a chief part in reconciling Henry IV. to the Church.

Dupetit-Thouars, LOUIS MARIE AUBERT, 1758–1831. French botanist. *Végétaux recueillis sur les isles de France*, 1804; *Genera nova Madagascariensia*, 1806; *Histoire d'un morceau de bois*, 1815; *Le verger français*, 1817.

Dupin, ANDRE MARIE JEAN JACQUES, 1783–1865. French advocate and legal writer, long deputy, repeatedly Pres. of the

Chamber; Academician 1832; Procureur-gén. 1857. *Memoirs*, 4 v., 1855–61.—His brother, FRANÇOISE PIERRE CHARLES, 1784–1873, Baron 1824, was an engineer, official, and prolific writer. *Travels in Gt. Britain*, 6 vols., 1820–24.

Dupin, LOUIS ELLIES, 1657–1719. Prof. Coll. of France 1686, banished as a Jansenist 1703. He labored in vain for the reunion of Christendom. *History of Ecclesiastical Writers*, 47 vols., 1686–1714, tr. 1693–1707.

Dupleix, JOSEPH, MARQUIS, ab. 1696–1763. Gov. of the French Indies 1742. He attempted to found a French Empire there, and gained control of the Carnatic, in s. Hindostan, but was defeated by Clive, and recalled 1754.

Duplex (TELEGRAPHY). System of multiple transmission, by which two messages may be sent over the same wire at the same time, either in the same or in opposite directions. The possibility of such a system was first suggested by Moses G. Farmer of Boston 1852.

Duplicate. A term applied to a variety of whist known in full as Duplicate-Whist. See WHIST.

Duplicate Ratio. Ratio of the squares of quantities.

Duplicidentata. See RODENTIA.

Duplicity. Conveyance of a false impression by means of language which may bear a double interpretation.

Dupont, PIERRE, 1821–1870. French lyric poet. His *Chant des Ouvriers*, 1848, became the rallying cry of the mob.

Dupont de l'Etang, PIERRE, 1765–1838. French general. He served at Marengo, Jena, and Friedland, but surrendered at Baylen, Spain, 1808, and was disgraced. He held office under Louis XVIII. and his successors.

Dupont de l'Eure, JACQUES CHARLES, 1767–1855. French liberal, Deputy 1817–48.

Dupont de Nemours, PIERRE SAMUEL, 1739–1817. French statesman and economist, who narrowly escaped the guillotine, wrote *Philosophy of the Universe*, 1796, while in hiding, was in the U. S. 1799–1802 and from 1815.—His son, ELEUTHERE IRENEE, 1771–1834, established 1802 the powder works near Wilmington, Del.—His grandson, SAMUEL FRANCIS, U.S.N., 1803–1865, bore part in the capture of Port Royal, S.C., Nov. 7, 1861, became Rear-Admiral 1862, and attacked Charleston April 7, 1863.

Dupré, JULES, 1812–1889. French landscape and marine

Jules Dupre.

painter of great power, broad execution, and exquisite color sense (low tone). Many of his paintings are owned in the U. S.

Dupuis, CHARLES FRANCOIS, 1742–1809. Prof. Coll. de France 1781. *Origine de tous les Cultes, ou Religion Universelle*, 10 vols., 1794.

Dupuy, CHARLES, b. 1851. French Deputy; Premier Mar.–Nov. 1893 and May 1894.

Dupuytren, GUILLAUME, BARON, 1777–1835. French surgeon and inventor; Prof. Paris 1812.

Duquesne, ABRAHAM, MARQUIS, 1610–1688. French naval officer, conspicuous in the wars with Spain and Holland; the only Protestant excepted from banishment 1685.

Duquesne. FORT. Built by the French on the site of Pittsburg, Pa., 1754; taken by the English 1758.

Dura Mater. Tough membrane which forms the outer investment of the brain and spinal cord.

Duramen. Heartwood of exogenous plants, named from its greater durability than the alburnum or sapwood.

Duran, AGUSTIN, 1789–1862. Royal librarian at Madrid 1836; collector of Spanish ballads.

Duran, EMILE AUGUSTE CAROLUS, b. 1837. French painter, especially eminent for portraits.

Durance. River of s. e. France, 225 m. long, tributary to the Rhone. It supplies Marseilles by an aqueduct 51 m. long.

Durand, ASHER BROWN, 1796–1886. N. A. 1826, Pres. 1845–61; American line engraver and painter. *Declaration of Independence*, after Trumbull; *Ariadne*, *Musidora*. He abandoned engraving for painting ab. 1835.

Durand, MME. ALICE MARY CELESTE (FLEURY), b. 1842, m. 1871. French novelist, bred in St. Petersburg, and writing as "Henri Greville" on Russian subjects. *Dosia*, 1876; *A Crime*, 1884.

Durand-Claye, ALFRED AUGUSTINE, b. 1841. French engineer.

Durand de St. Pourçain, GUILLAUME, ab. 1280–1334. Bp. of Annecy 1318, and of Meaux 1326; schoolman of the nominalist party, called Most Resolute Doctor. He wrote on canon law, on Peter Lombard, and against John XXII.

Durante, FRANCESCO, 1684–1755. Italian composer of church music, and teacher of a number of distinguished opera writers.

Durazzo. See DYRRACHIUM.

Durban. Chief port of Natal, s. Africa. Pop. 25,512.

Durbar. In India, an assembly held by a sovereign or ruler, equivalent to a Levee.

Durbin, JOHN PRICE, D.D., LL.D., 1800–1876. Pres. Dickinson Coll. 1834–45; Sec. M. E. Missionary Society 1850–72; author of *Observations in Europe and the East*, 4 vols., 1844–45.

Durchmusterung. Argelander's great survey of the northern heavens, completed 1846. Its results are embraced in a catalogue of approximate positions of 324,000 stars. In 1884 Schönfeld completed the extension of this survey to a distance 23 degrees s. of the equator. Recently, Thome of the Argentine Observatory has extended it to 42 degrees south declination. Schonfeld's catalogue contains places of 133,659 stars. Thome's catalogue will embrace 340,380 stars. Schonfeld's work embraces a larger proportion of faint stars than Argelander's and Thome's a larger proportion than Schonfeld's. The term is also applied to a photometric survey of the heavens in progress at Potsdam; also to a PHOTOGRAPHIC SURVEY (q.v.), two being now in progress.

Durene. $C_6H_2(CH_3)_4$. Tetramethylbenzene; solid hydrocarbon with odor like that of camphor; found in coal tar; also prepared by the action of methylchloride upon toluene.

Dürer, ALBERT, 1471–1528. German painter and engraver,

The Knight, Death, and the Devil, by Durer.

native of Nuremburg, the greatest of his school and time in

Germany. The Baumgärtner altar-piece, the Four Evangelists, and his own portrait in Munich, and the Holzschuler portrait in Berlin, are among his best paintings. Others are in Berlin, Vienna, Madrid, and Italian galleries. Although generally known as the father of wood engraving, he probably never produced a single block except as a matter of experiment, as the most famous of the wood blocks bearing his name were cut by various hands. But as an engraver on copper he is entitled to exalted rank. He occupies one of the highest places in the annals of the Graphic Arts. He was singularly felicitous in his composition and handling, to which he added rare poetic thought and feeling. Among his most famous plates are *Melancholy*, *Death's Horse*, *St. Jerome*, *Erasmus*, *Adam and Eve*, *Ecce Homo*, and *The Knight, Death, and the Devil*.

Duress. Actual or threatened violence or imprisonment, overcoming the will of the victim. It may be directed against the victim or his spouse, parent or child. A contract made under duress of goods is without consideration, and money paid under duress may be recovered.

Duret, FRANCISQUE JOSEPH, 1804–1865. French sculptor.

D'Urfé, HONORE, 1568–1625. French poet. *Astréa*, a pastoral.

D'Urfey, THOMAS, 1653–1723. English dramatist and lyric poet, of French descent.

Durga. Hindu goddess variously known as Bhawani, Kali, and Parvati, wife of Siva. As personified female energy the Yoni is her emblem. She is represented with ten arms holding various weapons, as she destroyed more giants than all the other deities together. Her annual festival at the end of September is the most splendid and popular of all Hindu feasts.

Durham. Town in n. England on a hill overlooking the River Wear. It was founded ab. 995. It has a magnificent Norman cathedral and castle, and a university established 1833. Pop. 14,863.

Durham. See CATTLE.

Durham, JAMES, 1622–1658. Minister at Glasgow. *Song of Solomon*, 1668.

Durham, JOHN GEORGE LAMBTON, EARL OF, 1792–1840. M. P. 1813; Baron 1828; Lord Privy Seal 1830–33; Envoy to Russia; Gov.-gen. of Canada 1838–39; radical reformer.

Durham Station, N. C. Gen. J. E. Johnston, C.S.A., surrendered here with 30,000 men to Gen. W. T. Sherman, April 26, 1865.

Durian. *Durio zibethinus.* Tall tree of the natural family *Sterculiaceæ*, native of the E. Indies, cultivated for its large spiny fruit, which is luscious, but of an offensive odor.

Durkheim. Town of Bavaria near Landau, amid beautiful scenery. Close by are the springs of Philippshall for invalids. In these waters Bunsen and Kirchhoff discovered in 1860–61 two new elements, Rubidium and Cæsium.

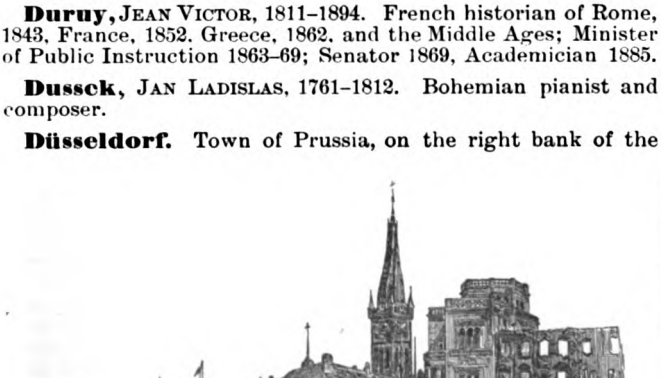
Duroc, GERARD CHRISTOPHE MICHEL, DUKE OF FRIULI, 1772–1813. French general.

Duroc Jersey. See SWINE.

Duruy, JEAN VICTOR, 1811–1894. French historian of Rome, 1843, France, 1852, Greece, 1862, and the Middle Ages; Minister of Public Instruction 1863–69; Senator 1869, Academician 1885.

Dussek, JAN LADISLAS, 1761–1812. Bohemian pianist and composer.

Düsseldorf. Town of Prussia, on the right bank of the Rhine, 18 m. below Cologne, noted for its gallery of paintings. It has iron, cotton, and other mills, and a large trade. It was fortified till 1802, and became a free port 1829. Pop., 1890, 144,682.



Düsseldorf from the Rhine.

Düsseldorf Academy. German school of painting which claims attention especially ab. 1825–50. Its leaders were W. Schadow, C. F. Lessing, E. Bendemann, K. Sohn, T. Hildebrandt, and J. Hübner. The pictures of this school are serious in purpose, but rather weak in color and in thought. At present their interest is mainly historical.

Dussieux, LOUIS ETIENNE, b. 1815. French historical writer, prof. St. Cyr 1842. *Historical Geography of France*, 1843; *Course of Geography*, 6 vols., 1859–65.

Dust. Any finely divided solid substance floating and slowly descending in the atmosphere. Specific names are given according to its origin, as meteoric, smoke, volcanic, pollen, diatomic, spore, etc.

Dust Explosion. In coal mining, caused by the sudden ignition of fine coal-dust, with or without the presence of a notable quantity of fire-damp.

Dust-Free. Air that has been filtered through cotton wool and so thoroughly cleansed of dust that a powerful beam of light fails to reveal a visible speck; according to Aitkin, 1886, fog particles collect around dust nuclei and by dragging them down leave the upper air dust-free.

Dust-Whirl. Small whirlwind that carries up dust and light objects. It occurs especially in close, hot, dry weather, when the vertical gradient of the density of the air is such that unstable equilibrium prevails and topsy-turvy interchange must occur. The whirl cannot easily occur when the sky is cloudy or when warm moist air prevails overhead, as is the case when a cyclone is near at hand.

Dutch Belted. See CATTLE.

Dutch East India Company. See EAST INDIA CO.

Dutch Gap Canal. Dug through a peninsula on the James ab. 5 m. below Richmond, Va., by order of Gen. B. F. Butler, Aug.–Dec. 1864.

Dutch Guiana. See GUIANA.

Dutch Language. Member of the Low German branch of the Germanic group. The Germans used and use this word *Deutsch* to designate their own tongue, and as "Pennsylvania Dutch" it is with us still equivalent to "German"; in general, however, Dutch is now applied exclusively to the language of the Netherlands. It is also spoken in certain Dutch colonies. Dutch, as a group of Low German dialects, was closely allied to earliest forms of English (see ANGLO-SAXON), and included the Frankish, spoken in Belgium and Flanders; the Frisian, once widely spread, but yielding ground to Frankish, and now mainly confined to Friesland, and Saxon. Dutch in its modern form, as a literary language, begins in the sixteenth century. See GERMANIC LANGUAGES.

Dutch Liquid. See ETHYLENE CHLORIDE.

Dutch Literature. The literature of the Netherlands really begins with the Flemish version of *Reynard the Fox*, translated from the French by one Willem, about the middle of the 13th century. Then followed the usual round of romantic, didactic and popular writings, until the nationality of the Dutch made itself felt not only in politics but in letters, and in Vondel (1587–1679) reached the level of genius. Vondel's *Lucifer* appeared more than a decade before Milton's *Paradise Lost*, and is thought by some critics to have had distinct influence upon the English epic. In modern times Dutch writers have turned with conspicuous success to the novel.

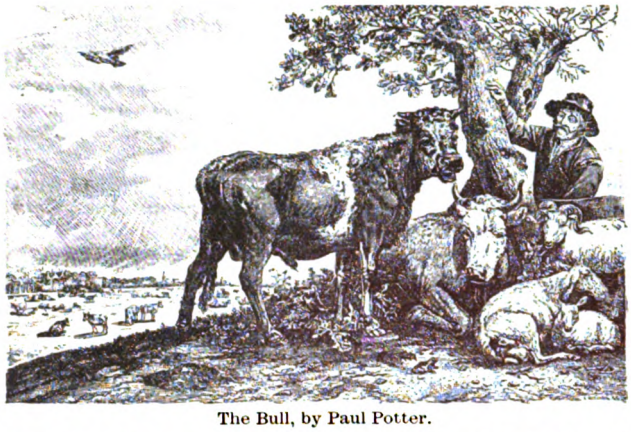
Dutchman's Breeches. Early spring flower, *Bicuculla cucullaria*, of the Poppy family, having a very irregular corolla, native of the e. U. S.

Dutchman's Pipe. *Aristolochia sipho.* High-climbing vine of the natural family *Aristolochiaceæ*, native of the s.e. U. S., having a very irregular flower; planted for ornament.

Dutch Metal. Imitation gold-leaf used for gilding. It is an inferior substitute, as it easily tarnishes, being an alloy of copper and zinc.

Dutch School of Painting. 17th century. Its greatest representative was Rembrandt, but it boasted innumerable other great names. As was natural to the art of a Protestant and wholly commercial country, the subjects affected are those of real life, domestic scenes, landscapes, cattle-pieces, and still life. This school represents the great prosperity and high civilization of the early Dutch Republic. The galleries of

Amsterdam, the Hague, and Haarlem, are especially strong in its works. Next to these is the Dresden Gallery.



The Bull, by Paul Potter.

Dutch West India Company. Organized 1621, dissolved 1674, after holding parts of Brazil 1624–54. Its successor existed 1675–1791. Its former possessions have been lost, except Dutch Guiana, Curaçao, and a few other islands.

Dutens, Louis, 1730–1812. French author, settled in England; editor of Leibnitz, 1769.

Dutertre, Jean Baptiste, 1610–1687. French missionary to W. Indies 1640. *Hist. Antilles*, 4 vols., 1667–71.

Duties. Actions or courses of action considered as being right: usually divided into three classes: duties to ourselves, to others, and to God; or, self-regarding, social, and religious. See Duty.

Duties. In Economics, taxes laid on commodities, either at the time of their production, of their conveyance from one part of the country to another, or of their importation or exportation.

Dutt, Toru, 1856–1877. Poetess of Calcutta, who wrote in English and French.

Duttlingen. In Germany. Here Weimar troops in French pay were almost exterminated by the imperial forces, Nov. 24, 1643.

Dutton, Clarence Edward, U.S.A., b. 1841. Connected with U. S. Geological Survey 1880–91; employed in the exploration of the West. *Geology of the High Plateaus of Utah*, 1880; *Tertiary History of the Grand Cañon District*, 1882; *Charleston Earthquake*, 1889.

Duty. In Ethics, requirement to do what is morally right and to abstain from what is morally wrong. In Law: 1, obligation to do or forbear an act; 2, indirect tax on goods, usually levied on imports.

Duty of a Pumping Engine. Number of foot-pounds of work done per 100 pounds of coal burned, or of 1,000,000 heat units. The latter definition was introduced by the Amer. Society of Mech. Eng. Early English unit was the work done in foot-pounds per bushel of coal. Values for various types of water-works pumps range from 65 million to 123 million foot-pounds.

Duumviri. Two Roman officials with diverse functions, as equipping a fleet, building a temple, trying for murder, or, in provincial towns, executing the laws.

Duval, Claude, 1643–1670. Norman-English highwayman.

Duvergier de Hauranne, Prosper, 1798–1881. French journalist and deputy; Academician 1870, Senator 1876. *Hist. Parliamentary Government in France*, 10 vols., 1857–73.

Duvernoy, Georges Louis. 1777–1855. Zoölogist; prof. Coll. de France 1837. *Organic Bodies*, 1842.

Duveyrier, Henri, 1840–1892. French explorer in Africa. *Sahara*, 1864; *Livingstone*, 1873; *Tunisie*, 1881.—His father, Charles, and uncle, Aime Joseph, were playwrights.

Duyckinck, Evert Augustus, 1816–1878, and George Long, 1823–1863. Authors of the *Cyclopædia of American Literature*, 1856.

Dvorák, Antonin, b. 1841. Bohemian musician. In youth he supported himself by playing in a dance-orchestra while studying at Prague. His successful career began in 1875, when he won a stipend of $160 from the Austrian Ministry of Education, which was increased 1877 to $240. His *Slavonic Dances* for orchestra soon made him known throughout the Western world, and he took rank with the best composers when his *Stabat Mater* was heard in London in 1883. He then began to write oratorios for the English choral festivals. In 1891 he came to New York as Director of the National Conservatory of Music, and at once began to stimulate an interest in American music, advising his students to study the characteristics of the slave songs of the South and other popular melodies. Their value as artistic material he exemplified in 1893 by composing a symphony *From the New World*, and a string quartet and quintet in the spirit of American Folk music.

Dwarfs. Various tribes in the region of the Middle Congo in Africa. They average four feet in height, have large heads,

Forest Dwarfs eating Snakes.

are bearded, cruel, and warlike. They dwell in beehive-shaped huts, arranged in circles in the forests. They cultivate nothing, live on wild fruits, herbs, etc., and hunt with poisoned arrows.

Dwarka. Sacred city of the Hindus in w. India at the mouth of the Gulf of Cutch. Here is a great temple, the most ancient shrine of Krishna, the Indian Apollo.

Dwight, Harrison Gray Otis, D.D., 1803–1862. American missionary in Turkey from 1829.—His son, William Buck, b. 1833, is an eminent geologist.

Dwight, John Sullivan, 1813–1893. American musical critic; founder *Journal of Music*, 1852, and its editor till 1881.

Dwight, Theodore, 1764–1846. M. C. 1806–7, ed. N.Y. *Advertiser* 1817–36, historian of the Hartford Convention, 1833, and biographer of Pres. Jefferson, 1839; brother of Dr. Timothy.—His son and namesake, 1796–1866, wrote a *History of Conn.*, 1841, and other books.

Dwight, Theodore William, LL.D., 1822–1892. Prof. of Law, Hamilton College, 1846–58; Warden Columbia College Law School 1858–91; Commisioner of Appeals, N.Y., 1874–75; grandson of Pres. Timothy. *Law of Persons and Personal Property*, 1894.

Dwight, Timothy, D.D., LL.D., 1752–1817. Pres. Yale Coll. from 1795. *Conquest of Canaan*, an epic, 1785. His *Travels in New England and N. Y.*, 4 v., 1821, were praised by Southey. His sermons, 5 v., 1818, had great influence at home and in England.—His grandson and namesake, b. 1828, became prof. at Yale 1858 and pres. 1886.

Dwina, or Duna. 1. River of w. Russia, flowing into the Gulf of Riga; length ab. 580 m. 2. River of n. Russia, entering the White Sea after a course of 450 m., or, with the Sukhona, 760 m.

Dyad. Element that has a valence of two; or one that is capable of replacing two atoms of hydrogen or other univalent element.

Dyaks. Natives of Borneo closely related to the Malays, than whom they are taller and of lighter complexion. Celebrated for their custom of each man securing as many heads as possible from human victims, for decorative purposes, a custom dying out before the advance of the whites. Intelligent and more moral than the Malays proper, yet are easily excited, slashing wildly at every one they meet.

Dyak Chief.

Dyas. Term used by Geinity for the Permian.

Dyaster. See DIASTER and INDIRECT CELL DIVISION.

Dybeck, RICHARD, 1811–1877. Swedish archæologist and collector of ballads.

Dyce, ALEXANDER, 1798–1869. Scottish editor of Bentley, 1836–38, of Shakespeare, 1857, and other Elizabethan dramatists.

Dyce, WILLIAM, 1806–1864. Scottish painter; prof. King's Coll., London, 1844; R. A. 1848.

Dyck, ANTHONY VAN. See VAN DYCK.

Dyeing. Art of coloring fabrics; the fibers most commonly dyed are cotton, wool, and silk. In order to take up the color evenly, they must be perfectly cleansed, usually by bleaching. Coloring matters may be classified as natural dyes, either animal or vegetable, and artificial dyes, the coal-tar colors. The only known color of animal origin is cochineal; of vegetable we have logwood, indigo, madder, and quercitron. The coal-tar colors are classified according to their composition and are very numerous. A few of the most common are Methyl Violet, Safranine, Magenta, and Methylene Blue. They are easily applied and give bright shades, but many of them are easily destroyed by the action of light, air, and certain gases. Some insoluble inorganic salts possessing color are sometimes precipitated upon the fiber and serve as dyestuffs; *e.g.*, Iron Buff and Manganese Brown.

The most practical classification of dyestuffs is by method of fixation. Certain dyes may be firmly fixed upon the cloth by immersing it in a solution of the dye. Colors thus applied are known as substantive dyes. Others require the intervention of a mordant or a compound which can be precipitated in an insoluble form upon the fiber, and which also possesses an affinity for the coloring matter which the cloth itself lacks. These are known as adjective dyes. The commonest inorganic mordants are the acetates and basic salts of aluminium, iron, and chromium, and the chloride of tin, which are precipitated upon the fiber by steaming or aging or some process by which the insoluble oxides are fixed upon the fiber. The principal organic mordants are: 1, tannic acid, as tannin, sumach, gallnuts, divi-divi, and other substances in which it is contained; 2, such oils as olive and linseed; 3, soaps. Fibers differ so greatly in their composition and therefore in their behavior toward reagents, and also in their affinity for dyestuffs, that the use of soaps and the mordant requires special consideration. Cotton, which withstands the action of chemicals more than either silk or wool, does not take up the dyestuff as well as the latter, and by means of mordants can be dyed by a treatment destructive to them. Silk and wool seldom requires a mordant, simple dipping in a slightly acid solution of the dye containing also a little soap being sufficient. Some dyes, termed polygenetic, are capable of developing two or more colors by using as many different mordants. The commonest example is madder or alizarine, which yields red with aluminium mordants and brown with chromium salts. The dye which has been applied to a fiber is detected by treating the latter with various reagents with which are given certain diagnostic reactions.

Dyer, SIR EDWARD, ab. 1540–1607. English poet and ambassador.

Dyer, GEORGE, 1755–1841. Historian Univ. Cambridge 1812.

Dyer, JOHN. 1700–1758. English poet. *Grongar Hill*, 1727; *The Fleece*, 1754.

Dyer, THOMAS HENRY, LL.D., 1804–1888. English historian. *Life of Calvin*, 1849; *Modern Europe*. 4 vols., 1861–64; *Kings of Rome*, 1867; *Pompeii*, 1866–68; *Athens*, 1873.

Dyer, WILLIAM TURNER THISTLETON, Ph.D., b. 1843. English botanist; director Kew Gardens 1885.

Dyer's Green-weed. *Genista tinctoria.* Yellow-flowered shrub of the natural family *Leguminosæ*, native of Europe, introduced into New England. Better known as Whin.

Dyer's Weed. *Reseda luteola.* Plant of the Mignonette family, native of Europe, introduced into N. America; known also as Dyer's Rocket and Dyer's Weld. Also *Isatis tinctoria.*

Dyestuffs. Substances used to color textile fabrics occur naturally and are also made artificially. Of the natural occurring ones, the only representative of the animal kingdom which finds application is cochineal, while the vegetable kingdom furnishes quite a number, some of which find considerable use. Among the latter are various roots, barks, fruits and even entire plants, and include madder, fustic, quercitron, peach, sapan, catechu, logwood, sumac, indigo, and others of lesser importance. The artificial dyestuffs are either colored insoluble inorganic compounds which are precipitated upon the fiber and include such as Prussian blue, manganese brown and others, or organic compounds in which the color may already be present and simply requires fixation, or in which the color is later developed by various chemical reactions. The artificial organic dyestuffs consist chiefly of the so-called "coal tar" or "aniline" dyes, of which already over five hundred are known. They are variously classified. For practical use they are divided into direct, acid, basic or mordant colors, depending upon the method in which they are applied to the fiber. When classified according to their chemical composition, they are divided into groups in which some combination of elements is common to all members of the group. Among these are: 1, nitro; 2, azoxy; 3, hydrazine; 4, azo; 5, nitroso and iso-nitroso; 6, oxyketone; 7, diphenylmethane; 8, triphenylmethane; 9, indophenol; 10, oxazine; 11, thiazine; 12, azine; 13, quinoline; 14, acridine; and 15, thyobenzyl colors. When a given group of elements is present in a series of colored compounds and to which their color is undoubtedly due, it is sometimes spoken of as a chemiophor. Dyestuffs, like other chemical compounds, give various reactions with certain common reagents which serve for their identification and separation.

Dying Declarations. Legally, relevant statements as to cause or circumstances of homicide, made by victim after hope of recovery is extinguished; receivable only in criminal prosecutions for homicide.

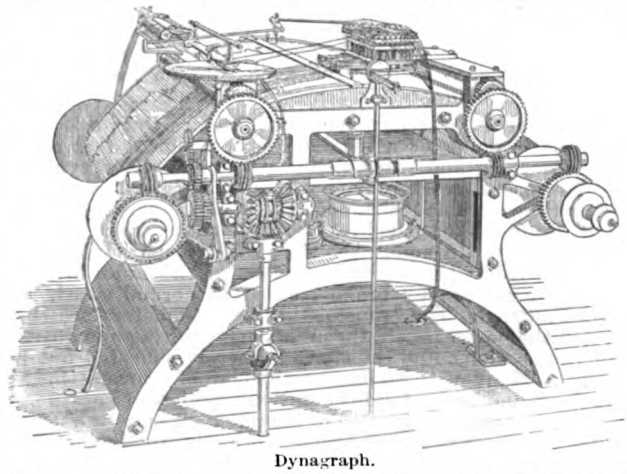
Dying Gladiator. Statue in Capitol Museum at Rome, really the statue of a Galatian warrior. It dates from the School of Pergamus, 3d century B.C., and is one of the finest works of the Greek decadence.

Dyke. Mass of igneous rock traversing sedimentary or other strata, often like a wall. Dykes are sometimes of great breadth, and as often exceedingly narrow. They cut the strata at all angles, and the rocks on each side frequently give evidence of the heated condition of the dyke at the time of its intrusion. The sides of volcanoes are usually intersected by dyke walls the materials of which were forced into them from the crater by hydrostatic pressure.

Dykes, JAMES OSWALD, D.D., b. 1835. Scottish divine, in London since 1869. *Abraham*, 1877.

Dykes, JOHN BACCHUS, 1823–1876. Vicar of Hull 1862; composer of tunes and anthems.

Dynagraph. Apparatus for autographically recording the force of traction of a locomotive, the power required to pull the train, and the condition of the track. The most complete one is that devised by P. H. Dudley, which is mounted in a special car placed between the locomotive and the train.



Dynagraph.

Dynamic Meteorology. Branch which specially deals with the forces and causes that produce motions in the atmosphere, with their resulting phenomena.

Dynamics. Science which treats of the action of forces in motion. It thus differs from Statics, which treats of forces at rest, and Kinematics, which treats of motion merely, without involving forces. Structures involve the principles of statics: machines those of dynamics.

Dynamic Theory of Storm Motion. Theory that makes the general movement of the storm depend principally on the inequalities of the distribution of pressure in the atmosphere as disturbed by the movements within the storm itself. Ferrel, Oberbeck, Köppen and Müller have contributed toward this view of the motions of storms.

Dynamite. Mechanical mixture of nitroglycerine with an absorbent such as sawdust or infusorial earth. It is a powerful explosive, frequently containing sodium, ammonium or potassium nitrates and up to 50 per cent nitroglycerine. It was invented by Alfred Nobel 1867. See ATLAS POWDER, DUALIN. GIANT POWDER, and EXPLOSIVES.

Dynamite Gun. See PNEUMATIC DYNAMITE GUN.

Dynamo Electric Machine. One for converting mechanical energy of motion into electric energy by the relative motion of a set of conductors, usually coils of copper wire, and magnetic lines of force. Since the dynamo is capable of effecting this energy conversion equally well in the inverse direction, all electric motors are classed under the head of dynamo electric machinery. The term was used first by Dr. Werner Siemens 1867, in a paper to the Berlin Academy. The magnetic field, or simply the "field," is generated by an electromagnet excited in one of three ways: if the entire current of the machine passes through the coils of the magnets, and the external circuit, the machine is called a series dynamo; if a part of this current only is shunted through the magnet coils, the rest going directly to the line, it is a shunt dynamo; if the field is maintained from an entirely separate source of energy, it is called a separately excited dynamo, if by permanent magnets, the apparatus is known as a magneto dynamo, or "magneto electric machine." The action of the dynamo is based upon the discovery of Faraday, 1831, that whenever a conductor is moved in a magnetic field so as to cut the lines of force, a current of electricity is generated in the conductor.

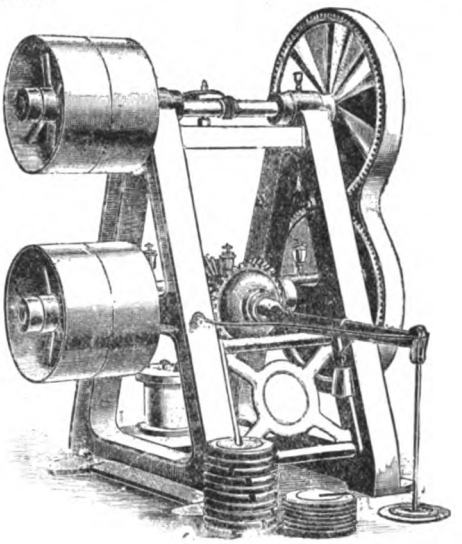
Dynamos differ greatly in the details of construction, these depending largely on the specific use to be made of the current generated. They may be divided into three classes: 1. Those in which there is rotation of a coil or coils in a nearly uniform field of force, such rotation being effected around an axis in the plane of the coil. Examples of this class are the Gramme, Siemens, Edison, Brush, and Thomson-Houston dynamos.

2. Those in which there is translation of coils to different parts of a complex field of varying strength or of opposite sign. Examples, Pixii, Clarke, Wallace-Farmer and Ayrton-Perry dynamos.

3. Those having a conductor rotating so as to produce a continuous increase in the number of lines of force cut, by the device of sliding one part of the conductor on or around the magnet, or on some other part of the circuit. Examples, Faraday's disk machine, Siemens' unipolar dynamo, and Forbes' non-polar dynamo.

Dynamogeny. Re-enforcing effect which a sensory stimulation may have on a muscular contraction not called out by the stimulus in question; *e.g.*, if a person's maximum strength of grip under normal circumstances as measured on a dynamometer be known, it is found that in certain cases this maximum will rise if a red light be directed upon the eye during the muscular contraction. In other words, the red light has a distinct dynamogenic value. The same is true for the other colors, as well as for sounds, tastes, smells, etc.

Dynamometer. Apparatus to measure the work which an engine is doing or a machine is absorbing. It is of two types, absorbing and transmitting. The absorbing types replace the useful work of the motor at a given speed, by a known or measurable resistance at the same speed. The friction or Prony brake is the best known of these, where a known weight is made to equal the force by which that weight would be lifted by the motor, the power of the motor being on the weight exerted by brake friction at normal speed. See BRAKE FRICTION. The transmitting dynamometers are those in which the power passes through the measuring apparatus to useful applications, and the effort is merely indicated but not absorbed. Many of these involve the plan of transmitting the effort from motor to follower through springs of known stiffness, whose flexure or tension or compression may be observed while the machinery is in motion. Or again, the bearings of a revolving transmitting wheel may be so mounted that the force transmitted may be measured by the effort necessary to hold them still. Traction dynamometers can be simply weighing machines, the horizontal pull replacing the vertical action of the weight.



Balance Dynamometer.

Dyne. C.G.S. absolute unit of force; that force which can impart to one gram mass the acceleration of one centimeter per second. There are 980.2 dynes in the weight of one gram at sea level in the latitude of Philadelphia.

Dyne-Centimeter. Absolute unit of work or energy in the C.G.S. system, usually called the Erg. It is equal to the work done by the force of one dyne acting through a distance of one centimeter.

Dyrrachium. Formerly Epidamnus; town on coast of Greek Illyria, founded 625 B.C. The expulsion of its nobles 436 B.C. was one cause of Peloponnesian war. It was the scene of Pompey's struggle against Cæsar 48 B.C., was besieged by Theodoric in 481; stormed by Norman Guiscard 1082; surrendered to Venetians 1205; ruined by an earthquake 1273, and taken by Turks 1503; now Durazzo.

Dysdipleura. See DIPLEURA.

Dysentery. Inflammation of the mucous membrane of the rectum and colon, marked by fever, frequent evacuations of bloody mucus and painful straining. It occurs usually in summer and autumn, is often epidemic, is more common in hot climates, is apt to occur in camps, etc., where hygienic surroundings are bad, and when severe may leave permanent injury of the intestines. When epidemic and in unhealthy locations it is very fatal.

Dysmenorrhœa. Painful menstruation. It may be due to undue congestion or inflammation of uterus, obstruction, formation of membranous clots, disease of ovaries, or be simply neuralgic.

Dysmerogenesis. See DYSMEROMORPH.

Dysmeromorph. Compound animal or colony of units, zoöids, metameres, and the like, in which the units cannot exist independently of the parent stock, but the parent stock is practically or actually one bion.

Dyspepsia. Imperfect digestion of food. It may be gastric or intestinal, according as it occurs in the stomach or intestines, and is due to acute or chronic inflammations of these organs, lack of tone, reflex influence of other organs, improper food, fever, and many minor causes.

Dysporomorphæ. Order of birds equivalent to a portion of the Natatores, including Pelicans, Cormorants, Frigatebirds, Solan-geese, etc. See STEGANOPODES.

Dyssycus. See RHAGON-TYPE.

Dysteleology. Study of rudimentary and vanishing organs, showing that the parts of the body are not specially created to be perfectly adapted to the conditions of life; opposed to teleology.

Dytiscidæ (SWIMMING BEETLES). *Coleoptera* with pentamerous tarsus, a pair of thread-like, ten- or eleven-jointed antennæ, and feet broad and hairy, adapted for swimming, especially the hind pair.

Dyveke, 1488–1516. Favorite of Christian IV. of Denmark, daughter of an innkeeper. She was poisoned by the court faction 1516, in consequence of the political power acquired by her mother. Her tragic fate and the King's revenge have inspired famous tragedies and romances.

E

E. The small letter *e* is used as the symbol for the base of the Napierian system of logarithms = 2.71828 etc. It is also used to represent the eccentricity of a conic.

Ea. The earth goddess of early Babylonian mythology and one of the triad that stood at the head of the ancient gods, and who afterward became the god of life and knowledge and the father of Bel-Merodach, the tutelary divinity of Babylon.

Eadgar. See EDGAR.

Eadie, JOHN, D.D., LL.D., 1810–1870. Scottish commentator and N. T. reviser. *The English Bible*, 1876.

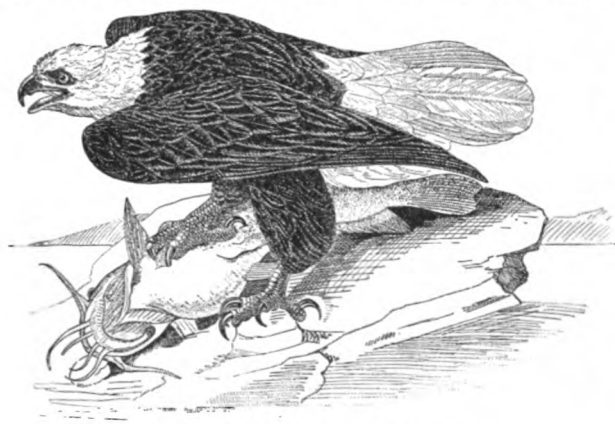
Eadmer, d. 1124. Monk of Canterbury and biographer of Anselm.

Eadmund. See EDMUND.

Eads, JAMES BUCHANAN, LL.D., 1820–1887. Civil engineer; designer of the large steel arch bridge at St. Louis, and of the South Pass jetties for the improvement of the Mississippi.

Eadward. See EDWARD.

Eagle. Bird of sub-family *Aquilinæ*, of family *Falconidæ*, including, besides Eagles proper, also BUZZARDS (q.v.). Bill of eagles is not toothed, the legs and feet are short and strong, tarsus scutellate both before and behind or else feathered, the claws long and curved, wings short and rounded, plumage very variable. Have been known to live over 80 years in confinement. Principal American genera are *Aquila*, the golden eagle,



White-headed Sea Eagle, or Bald Eagle.

with tarsus feathered to the toes, and *Haliaëtus*, the bald eagle, tarsus feathered only half-way to toes; former with golden-brown head, latter with white head and tail after third year. Length 36 in. The Bald Eagle (emblem of U. S.) feeds on fish, sometimes secured by robbing the Osprey and sometimes found as carrion. Eggs 3 in. long, laid early, two in a nest, usually in a high tree near the coast. See also LAMMERGEYER, HARPY, and ACCIPITRIDÆ.

Eakins, THOMAS, b. 1844. American painter; expert in anatomy. He had important paintings at the World's Fair, Chicago, 1893.

Eames, EMMA, b. 1868 in China. American singer. She appeared in Paris 1889, and in 1891 m. a son of W. W. Story.

Ear. Organ of hearing. In man it is made up of the outer or external ear, the middle ear, tympanum or drum, and the internal ear or labyrinth. The external ear consists of cartilaginous framework covered by skin provided with muscles, rudimentary in man, but capable in animals of moving ear in all directions. The middle ear is a cavity in the temporal bone separated from the external ear by the thin tympanic membrane often improperly called the tympanum. In this cavity are three small bones, the malleus, incus and stapes, loosely united by ligaments. forming an irregular chain. The malleus rests on the tympanic membrane and the stapes upon an opening (fenestra ovalis) closed by a membrane of the outer wall of the internal ear. Through these bones the vibrations of the tympanic membrane are communicated to the internal ear. The eustachean tube communicates with the throat, allowing the entrance of air which equalizes the atmospheric pressure on each side of the membrane, the tension of which is regulated by small involuntary muscles. The internal ear or labyrinth contains the semi-circular canals and the cochlea. The canals are three in number, one nearly horizontal, the others nearly vertical, and are supposed to assist largely in the perception of the position of the body, as injuries to them or diseases of them are followed by vertigo or inability to maintain an erect position. In the cochlea terminates the auditory nerve which transmits impressions of sound to the brain. The most common disease of the ear is Otitis or inflammation, characterized by pain and the secretion of pus. It may result fatally by extending to the brain. In invertebrates the ears are often not on the head, and if so they are on appendages. In some jellyfish they are modified tentacles. In crayfishes they are in the basal joints of the antennules. In insects they are at the base of the abdomen. See AUDITORY ORGANS, OTOCYSTS, LITHOCYSTS.

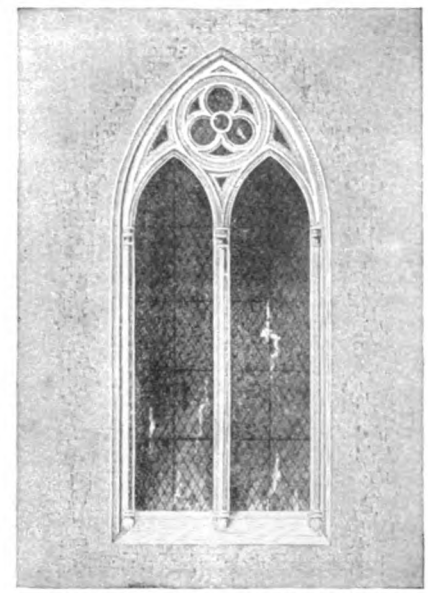
Eared-Seals. See OTARIADÆ and SEALS.

Earings. Small ropes used to fasten the upper corners of sails to the yards.

Earl. Old Saxon title of nobility, distributed to his officers by William I. and made hereditary.

Earlham College. At Richmond, Ind., founded 1847; chartered 1859; patronized by Friends. It admits both sexes, has a teaching staff of 20, and offers 8 four-year courses of collegiate study.

Early English Architecture. The beginnings of the Gothic Style imported from France. It is called, perhaps more correctly, "First Pointed" and was practiced for nearly a century, beginning ab. 1190. The name "Lancet" also applied to the style is descriptive, as denoting the characteristic form of



Window, Arrston Church, Isle of Wight.

openings. The tracery which in later Gothic becomes so important was introduced but sparingly before the middle of the thirteenth century. The most striking differences between Norman and Early English work are the substitution of long and narrow windows with pointed arches for the wider openings and lowered arches of the preceding period, the introduc-

tion of projecting buttresses and the steeper pitch of the roofs. In the moldings the difference is equally marked, these becoming much more varied and elaborate, and alternating rolls or pear-shaped projections with deeply-channeled recesses, and the ornament becomes more profuse and more intricate, the chisel having been substituted for the ax at the beginning of the period. Two or three lancets were joined together and finally united under a single relieving arch, and the introduction of tracery in the bend thus suggested and brought about. The interior of Westminster Abbey, though in plan and arrangement distinctly French, is probably the most instructive example of the style of which it furnishes a compendious history from the plainness and severity of its beginnings to an enrichment which marks the progress of Gothic architecture into the "Middle Pointed" or "Decorated" style.

Early, JUBAL ANDERSON, 1816–1894. Confederate General, prominent at Fredericksburg and Gettysburg. He invaded Md. July, 1864; was defeated in Va. by Sheridan, Sept. 19 and 22, and at Cedar Creek Oct. 19, after routing the Federals in Sheridan's absence; defeated by Custer, March 1865.

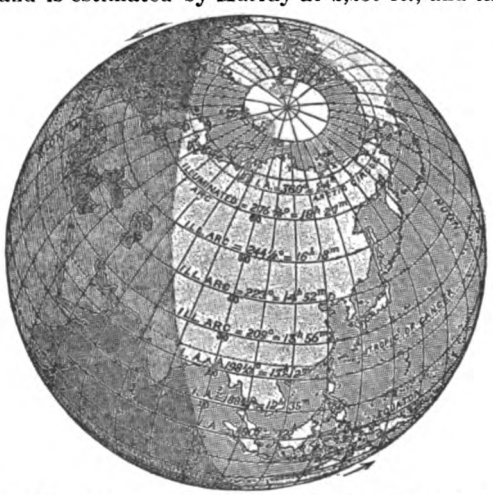
Earnest. Thing given to bind a bargain, showing the parties to be in earnest; a mode of binding the contract, and not necessary to pass title. Under the statute of frauds it must be given outright, not handed to the seller and returned, nor put into a third person's hands to be forfeited upon a contingency.

Earnings of Management. That part of the gross profits of any business which is in excess of the ordinary interest on the capital invested. It is the inducement which leads the employer into business.

Ear-ring. Ornament, sometimes set with pendent gems, worn in all ages and countries by women, and frequently by men, as in England and France during the 16th and 17th centuries. Assyrian sculptures show the king and nobles wearing large ear-rings. The ears of Greek statues of women are also pierced for rings.

Earth. Third planet in order of distance from the sun; period of revolution about the sun 365.2564 days, about its axis 23h., 56m., 4.09s.; equatorial diameter 7,926.592 miles; polar diameter 7,901.476 miles; density 5.58 times that of water. Our direct knowledge of the earth is confined almost exclusively to the surface, it being possible to penetrate only an insignificant distance into the interior. From such data as we possess the temperature is found to increase as we descend at the rate of 1° F. for every 50 or 60 ft. If this rate continues, of which we have no direct knowledge either way, at a comparatively small depth the temperature will be sufficiently great to melt all known substances; hence the conclusion at one time universally held that the center is a molten mass, the outside crust being at most only a few hundred miles in thickness. On the other hand Lord Kelvin and G. H. Darwin, from investigations of the phenomena of tidal action and of precession, have reached the conclusion that the earth as a whole must be a solid body, more rigid than if made of solid glass.

In form it is an oblate spheroid, eccentricity being 1: 294.98, as deduced by Clarke. The cubic contents are 260,000,000,000 cubic miles. Its weight is 5,852,000,000,000,000 tons. The total superficial area is 192,200,000 sq. m., of which 55,000,000 are land and 137,200,000 are covered by the sea. The mean height of the land is estimated by Murray at 2,250 ft., and the mean



View of Earth from the zenith of a point in 50° N. lat. and 90° E. long. at 6 o'clock P.M., on its summer solstice (21st June):

The figures on the parallels of latitude indicate the length of the illuminated arc in degrees, and the period of daylight (longest day) in hours.

depth of the sea at 12,480 ft. The land is comprised in four bodies sufficiently large to be considered as continents, America, or the Western continent, the Eastern continent, comprising Europe, Asia and Africa, Australia, and the Antarctic continent, besides a vast number of islands of various sizes. The areas and mean heights of the principal divisions of land are given below, as estimated by Murray:

Europe	3,670,100	939
Asia	16,368,500	3,189
Africa	11,092,750	2,021
N. America	7,623,050	1,888
S. America	6,861,400	2,078
Australia	3,014,050	805

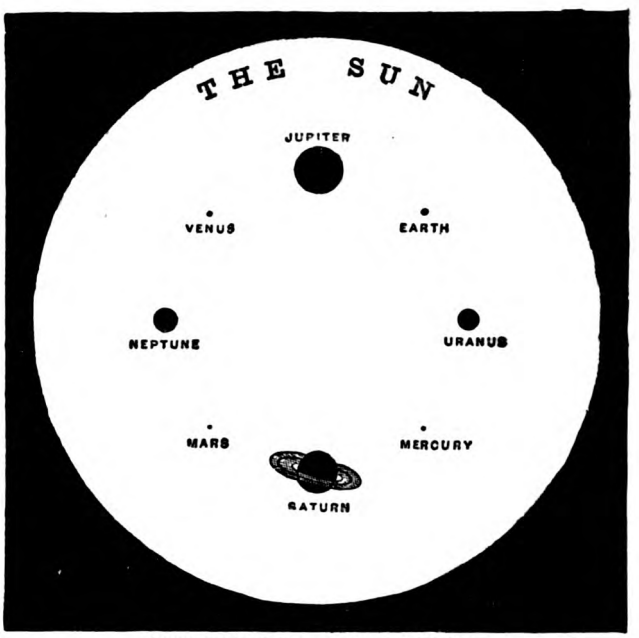
The bodies of land are in most cases broadest at their n. ends, tapering to points southward. This peculiarity is shown in peninsulas and islands, as well as in the continents. Three-fourths of all the land is in the northern hemisphere.

The sea is divided into the Atlantic, Pacific, Indian and Arctic oceans, that which is commonly known as the Antarctic ocean being merely the extensions of the first three. Their areas are:

	Sq. Miles.
Atlantic	36,000,000
Pacific	67,500,000
Indian	28,700,000
Arctic	5,000,000

The earth is enveloped in an atmosphere 1,000 miles high. See ATMOSPHERE, EARTH'S, and DENSITY OF THE EARTH.

Earth, FIGURE OF. The ancients supposed the surface of the earth to be a plane. Aristotle first gave good reasons for supposing it to be a sphere. Modern measurements have



Comparative Sizes of Sun and Planets.

proved that it is an oblate spheroid, very closely, having an ellipticity of $\frac{1}{299}$; that is, the amount of flattening at the two poles is $\frac{1}{299}$th of the equatorial diameter. Erastothenes ab. 230 B.C. found that at Syene in Upper Egypt on the day of the summer solstice the sun passed exactly through the zenith, while at Alexandria its meridian zenith distance was 7° 12′. The distance between these places being measured, the length of 7° 12′ became known, and by a simple process that of 360°, or the circumference of the earth. This method was perfectly correct in principle. A similar measurement was made by Posidonius, and by Caliph Almamoum 814. We are unacquainted with the results of these operations, but they could not have been more than rough approximations.

The first determination entitled to much confidence from a scientific point of view was that of Picard in France 1669. From this source Newton obtained the data necessary to his famous researches relating to gravity. About this time doubts began to arise whether the earth were an exact sphere. Theory had advanced sufficiently to indicate an oblate spheroid as the probable form, while some measurements made in France by J. and D. Cassini unexpectedly and erroneously indicated a prolate spheroid.

To settle the question, which had now attracted great attention, the French Academy in 1755 determined to obtain measurements at two points differing as widely as possible in latitude. Expeditions, which are famous in the history of science,

were sent to Lapland and to Peru; the results then arrived at have not been greatly changed by subsequent investigation.

The latest researches indicate the general form of the earth to be that of an ellipsoid, the three axes having the following lengths: polar axis, 41,708,954 feet; equatorial diam. (*a*) 41,853,258 feet, equatorial diam. (*b*) 41,850,210 feet. The greatest equatorial axis being in longitude 8° 15′ west of Greenwich. The continental elevations and ocean depressions constitute, however, very appreciable departures from a true mathematical figure.

Earth-Closet. Form of closet where dry earth is used as a deodorizer and disinfectant, the matter being removed at intervals. It is suitable for country houses where a water-closet cannot be conveniently established.

Earth Metals. In Chemistry, aluminium, zirconium, cerium, glucinum, lanthanum, thorium, didymium, yttrium, and erbium. The oxides of these metals are called earths.

Earth-Pea. See PEANUT.

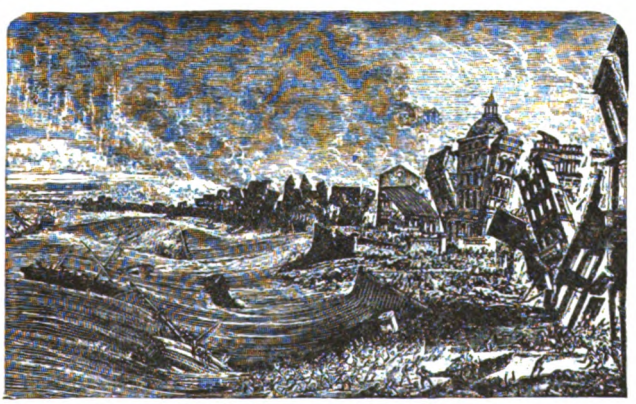
Earth Pressure. The lateral pressure of earth against a wall is less than that of water. If a be the angle of natural slope of the earth, w its weight per cubic foot, and h the height of the vertical wall, the formula

$$P = \tfrac{1}{2}\, w\, h^2 \tan^2 (45° - \tfrac{1}{2}a)$$

gives the total pressure on each linear foot of the wall.

Earthquake. The cause of the earthquake has long been one of Nature's grand secrets; but modern investigation has found it in those slips and fractures of the crust which are unavoidable results of the now accepted doctrine of the Earth's internal structure. The outer shell, being cold and unyielding, is compelled to bend and break by the compressing force resulting from the shrinking away of the cooling core below. From time to time slips and subsidences occur, which, though of small extent, yet involve so large masses of the crust that the following shock is often very violent. The fall of a section of the Earth's crust through the space of only half an inch is sufficient to produce a severe earthquake. The vibrations propagated from its focus, the depth of which has been calculated at from five to twelve miles, emerge at the surface at angles varying with the distance from the epicentrum or point immediately above the focus, and gradually die away, after ranging over hundreds, or even thousands, of miles. Like other vibrations, the earthquake-wave is subject to refraction and reflection, and these probably produce many of the exceptional phenomena observed.

History contains numberless records of earthquakes from the earliest times, few of them definite enough for scientific purposes. In modern times the great earthquake of Callabria in 1783 lasted for four years, and was probably the first that was studied by competent visitors. The geologist Dolomieu assures us that growing trees bent over and touched the earth. Contemporaneous disturbances occurred in Iceland. The story of the earthquake at Lisbon, 1755, is familiar. An area four

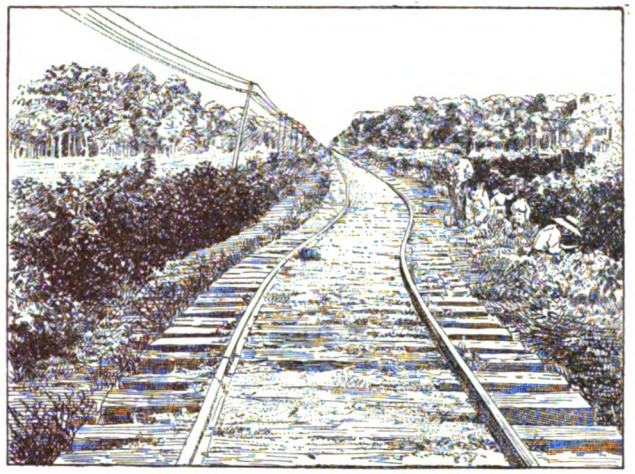


The Earthquake at Lisbon in 1755.

times as large as Europe was then shaken, and the undulation was propagated, according to the best calculations, at 20 m. a minute. In 1746 Peru was terribly shaken; 19 ships were sunk in the harbor of Callao; and nearly the whole population of Lima was destroyed.

But for scientific purposes and fullness of known details the great earthquake of Aug. 1883 in the Straits of Sunda is the most remarkable. In the volcanic explosion which caused it a great part of the island of Krakatoa was blown away. Immense quantities of ash were flung into the air and carried by the winds all round the globe, causing brilliant sunset glows. The air wave produced by the concussion recorded itself on the barographs, passing three times round the globe before it ceased to be appreciable, while the water wave starting from the same point was registered by the tide gauges during one entire circuit of the earth. The report of the Royal Society on this earthquake constitutes an epoch in Seismology.

The two most remarkable earthquakes in the e. U.S. were those of New Madrid 1812 and Charleston 1886. During the former a large tract of country below Cairo, Ill., sank to a depth of ab. 10 ft. and thus acquired the name of the "Sunk Country," some of which has remained flooded ever since. During the latter, whose center was near Charleston, S. C., nearly the whole eastern coast was shaken. The focus of this earthquake was



View near Charleston after Earthquake 1886.

calculated to lie at a depth of 12 m. on a line of weakness in the crust separating the continental from the oceanic area. This, which is called the Fall's Line, extends through all the Atlantic States, from N. J. s.w., and is marked on the surface by a sudden descent, producing falls or cataracts in all the rivers coming from the upper country.

Japan, owing to its unequaled advantages for the purpose, is taking a high position in Seismology, and some very valuable results have already been obtained by Japanese investigators.

Earths, Alkaline. See ALKALINE EARTHS.

Earth Shine. The sun's light, reflected by the earth to the moon when the latter is a narrow crescent, renders the entire disk visible.

Earth Star. Certain Fungi of the order *Lycoperdaceæ*, and genus *Geaster*, whose outer peridium splits longitudinally and becomes reflexed, assuming a stellate appearance.

Earthwork. Excavation of earth for railroad and canal cuts and the building of embankments. It is measured in the excavation, and its cost ranges from 10 to 30 cents per cubic yard, depending on the length of haul. In moving earth, wheelbarrows are used for distances less than 100 feet, carts for distances up to half a mile, and railroad cars for longer distances.

Earthworks. Defensive positions were formerly protected by means of permanent works having masonry scarps and counterscarps, requiring regular siege operations to reduce them. Positions of temporary military importance may be made more secure by fortifications constructed entirely of earthen parapets with revetments also temporary, as gabions, fascines, and hurdles. The principal classes are lines with intervals, continuous lines, redoubts, redans, and bridgeheads. The profile of these works consists usually of the exterior slope, generally the natural slope of earth; the superior slope, or that of the most depressed line of fire required for exterior defense; the interior slope, or that inclination best suited for delivering musketry fire; the banquette, and the banquette slope which unites the tread with the interior surface of the work. Other earthworks for the protection of field and siege batteries receive such a thickness of parapet as will secure them from through penetration by the artillery projectiles of the enemy. Shallow trenches for the rapid covering of infantry when brought into action upon ground that is to be held for a short time belong also to earthen fortification.

Earthworm. See TERRICOLÆ.

Ear-Trumpet. Instrument of metal, horn, or similar substance having one extremity for insertion into the ear and the other expanded to collect sound waves. Occasionally the portion inserted in the ear is connected with the receiver by flexible tube.

Earwig. See FORFICULIDÆ.

Easel. Frame which artists use for holding the canvas steady while at work.

Easement. Right to a specific use of another's land, consistent with the latter's general right of property. It arises by nature, by dedication, by actual grant, by implied grant, or by prescription; it is extinguished by release or by abandonment.

East. Quarter of the heavens in which the sun rises. As from the earliest ages the sun was regarded as the source of light, knowledge, and purity, the point of its appearance came to be regarded with reverence and the eastward position at prayer was assumed by many creeds and Christian churches were built pointing e. with the altar at the e. end.

East, Sir Edward Hyde, 1764–1847. Chief-Justice of Supreme Court, Bengal, 1813–22. *Pleas of the Crown*, 1803; *Reports*. 16 vols., 1801–14; *Term Reports*, 5 vols., 1817.

East Anglia (Norfolk, Suffolk, Cambridge, Ely). East Anglian kingdom, n. of Essex; founded by Uffa ab. 575; subject to Mercia 792, to Wessex 825.

Easter. Festival to commemorate our Lord's resurrection, fixed by Council of Nice 325 as the Sunday following the first full moon after vernal equinox: the latter being March 21, Easter may fall on any date between that and April 26.

Easter Eggs. Emblems of the Resurrection, surviving in Christian observances at the Easter festival from primitive times, when the egg was regarded as the symbol of the renewal of life. The use of eggs at the spring festival was common to many of the nations of antiquity, and a parallel custom exists in China.

Easter Island, or Waihu. In the Pacific, lat. 27° 6′ S., long. 109° 30′ W.; area 47 sq. m.; volcanic; discovered 1722; noted for

Stone Statues on the side of the Volcano Ronororaka, Easter Island.

rude stone statues, busts and other remains, of unknown origin. Since 1860 most of the natives have emigrated or perished.

Eastern Churches. Greek, Nestorian, Armenian, Syrian, Coptic, and Abyssinian, with secessions from these to the rule of Rome, retaining most of their usages.

Eastern or **Byzantine Empire.** Founded 395 on the death of Theodosius, and division of the Roman Empire between his sons. The e. portion, including Syria, Asia Minor, Pontus, Egypt, Thrace, Mœsia, Macedonia, Greece, and Crete, fell to Arcadius. His son Theodosius II. resigned the government to his sister Pulcheria. Marcianus, her husband, repelled Attila. The Arian controversies disturbed the following reigns. Invasions of Goths were averted by various devices; against the Bulgarian raids, Anastasius I., 491–518, built the Long Wall protecting Constantinople; he had wars with the Persians. The army next placed Justinus I. on the throne. His nephew, Justinian, succeeded, 527–565; his name is associated with his code of laws, with the building of the great cathedral of St. Sophia, and with the victories of Belisarius and Narses. The empire declined after his death. The tyrannical Phocas was overthrown 610 by Heraclius, who successfully opposed the Persians. The Arabs, led by Omar, now advanced on their conquering course, and the divided Greek power, weakened by religious quarrels, could offer little resistance. The dynasty of Heraclius expired with Justinian II., 685–711. His successors were deposed, or abdicated, till Leo the Isaurian, 717–41, who repelled the Arabs from Constantinople, and occasioned an outbreak of the Image Controversy. His dynasty ended with Constantine VI., who died 797, after being blinded by his mother Irene. Rapid changes of dynasty ensued during which the Arabs gained ground. The Image Controversy was closed at the Council of Nicæa 842. The Macedonian dynasty, 867–1056, was founded by Basilius I. Arab and Bulgarian inroads increased, and the Russians appeared as a hostile power. Basilius II., 976–1025, conquered the Bulgarians. Romanus III. was assassinated by his wife Zoe, under whose three succeeding consorts, 1034–54, Russians and Arabs laid the empire waste, while the Turks advanced in Asia. Isaac I. founded the Comnenus dynasty 1057, which continued till 1185, some of its later members being able rulers. In 1204 Constantinople was taken by the Crusaders, and the empire was divided. The first part, including the capital, fell to Baldwin, Count of Flanders; the Venetians had another share; Theodore Lascaris ruled at Nicæa, and Alexius Comnenus at Trebizond. John Vatazes, of Nicæa, 1222–1255, afterward seized a great part of the empire. Michael VIII., with the Genoese, took Constantinople 1261, ending the Latin dynasty and founding that of the Palæologi, during whose reign the Turks gained footing in Europe, till the dominion of Johannes VI. 1444 was confined to Constantinople, which was finally taken by Mohammed II., May 29, 1453, and the Byzantine empire was no more: the long story of crime, dissension and tumult was ended. The constitution of the empire was despotic, and the imperial court was characterized by stately ceremonial. All public officials were immediately dependent on the emperor who was superior to all laws. The state revenue was identified with the privy purse. The army consisted mainly of mercenaries.

Eastern Haze. Peculiar black misty appearance in the horizon, seen in England when easterly winds are approaching over the Channel and North Sea.

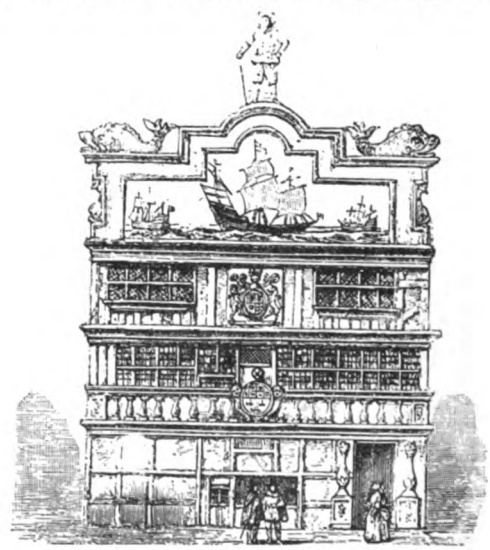
Eastern Question. Concerning the ultimate division of the Turkish empire, and the fortunes of states and provinces still or recently part of it. The main factors are Russian (and to a less extent Austrian) ambition, and British jealousy of Russia; these caused the Crimean war, threaten the peace of Europe, and delay an inevitable doom. The balance of power is the chief of many elements which make up this problem.

Eastern Rite. Ritual of those Eastern Churches or parts thereof as have submitted to the pope; conducted in several languages and after their ancient usages, including communion in both kinds and clerical marriage.

Eastern Rumelia. Province 1878–86, s. of Balkan Mts.; now part of Bulgaria.

Eastern Shore. Eight counties of Md. and two of Va., e. of Chesapeake Bay.

East India Company. Formed 1709 by the union of several trading associations chartered in England 1600–98. Its property was vested in the crown 1834, and all its rights transferred to the crown 1858. It was the beginning of England's



Old East India House, London ab. 1650.

Eastern Empire. The Dutch E. I. Co., formed 1595–1602, acquired large possessions, of which Java remains. The French Co., dating from 1664, was a dangerous rival of the British till overthrown by Clive ab. 1754.

East Indian Army, British. Besides the British army of occupation, numbering 73,981 men, India has an auxiliary permanent force of 141,301 privates officered by 2,757 natives and 1,578 Europeans. Of these there are 4,543 artillery, 23,426 cavalry, 3,965 sappers and miners, and 113,702 infantry.

East Indies. Farther India (Lower Burmah, Siam, etc.) and the Malay Archipelago (Sumatra, Java, Borneo, the Philippine Isl., etc.). Properly, Hindustan also is included.

Easting. Distance of one end of a line e. of the other end. Westing is negative easting. See Departures and Latitudes.

Eastlake, Sir Charles Lock, D.C.L., F.R.S., 1793–1865. Eng. historical painter; pres. Royal Acad. 1850; knighted 1850. As director of the National Gallery from 1855 he added largely to its collections. *Materials for History of Oil Painting*, 1847.

East Liverpool. City of Columbiana co., O., on the Ohio. Pop., 1890, 10,956.

Eastman, JOHN ROBIE, Ph.D., b. 1836. Prof. of Mathematics U. S. Navy 1865, assigned to U. S. Naval Observatory-in charge of the meteorological records; author of *Annual Meteorological Tables*, and special reports on barometric, rainfall, and meteoric observations.

Easton. Capital of Northampton co., Pa., at the junction of the Lehigh and Delaware rivers; settled 1790; site of Lafayette College. Pop., 1890, 14,481.

East Orange. Suburban town of Essex co., N. J., w. of Newark. Pop., 1890, 13,282.

East River. Strait between New York and Brooklyn, 18 m. long.

East St. Louis. Suburb of St. Louis, in St. Clair co., Ill., on the Mississippi. Pop., 1890, 15,169.

Eastwick, EDWARD BACKHOUSE, 1814–1883. English official in India and Persia. *Hindustani Grammar*, 1847: tr. Bopp's *Comparative Grammar*, 1846, Saadi's *Gulistan*, 1852, and other Oriental works.

Eaton, AMOS, 1776–1842. Geological surveyor for the Erie Canal, 1820; pres. Rensselaer Polytechnic Inst. 1824. *Botany of N. America*, 1817–41; *Index to Geology of Northern States*, 1818; *Engineering and Surveying*, 1838.—His grandson, DANIEL CADY, 1834–1895, prof. Botany at Yale 1864, pub. *Filices Wrightianæ et Fendlerianæ*, 1860; *Ferns of N. America*, 1879; and papers on *Pteridophyta* and *Bryophyta*.

Eaton, DORMAN BRIDGMAN, LL.D., b. 1823. U. S. Civil Service Commissioner 1873–75 and 1883–86. *Civil Service in Gt. Britain*, 1880.

Eaton, JOHN, LL.D., b. 1829. U. S. Commissioner of Education 1870–86; pres. Marietta Coll., O., 1886–91.

Eaton, JOHN HENRY, 1790–1856. U. S. Senator from Tenn. 1825–29; Sec. of War 1829–31; Gov. of Fla. 1834–36; U. S. Minister to Spain 1836–40. *Life of Jackson*, 1824.—His wife, MARGARET L. (O'NEILL), 1796–1879, aroused the jealousy of Washington ladies; Pres. Jackson's violent support of her cause led to the disruption of his cabinet 1831.

Eaton, WYATT, b. 1849 in Canada. Painter, ranking among the greatest of American colorists.

Eau Claire. Capital of Eau Claire co., Wis., at junction of Eau Claire and Chippewa rivers, at the head of navigation on the latter stream. Pop., 1890, 17,451.

Eau de Cologne. Perfume said to consist of 12 drops each of the oils of neroli, citron, bergamot, orange, and rosemary, distilled with a drachm of Malabar cardamoms and a gallon of rectified spirit. The recipe is usually credited to Johann Maria Farina (1685–1706), who first made it in Cologne ab. 1709.

Eau de Javelle. See JAVELLE WATER.

Eaux Bonnes. French watering-place in the Basses-Pyrenees situated 29 m. s. of Pau, 2,454 ft. above sea-level. Its hot sulphur springs are frequented for pulmonary affections. Pop. 917.

Eaux Chandes. Watering-place in the French Pyrenees 29 m. s.w. of Pau. Its hot springs are sought by patients suffering with rheumatism and cutaneous diseases.

Eaves. Overhanging edges of a roof, so extended to cast off rain and snow and prevent them from sapping the base of the wall. In those countries where this danger is greatest, as in Norway and Switzerland, the eaves are correspondingly developed.

The Old Parsonage at St. Peterszell, Switzerland.

Eavesdropping. Criminal offense of secretly loitering about a building to overhear discourse therein, and to repeat the same to the annoyance of others.

Ebal. Mountain opposite GERIZIM (q.v.). From it the curses of the law were uttered.

Ebbo, 786–851. Abp. of Rheims 816; twice expelled.

Ebed Jesu, called "SON OF THE BLESSED," d. 1318. Metropolitan of Nesebis in Armenia; poet and theologian.

Ebel, HERMANN WILHELM, 1820–1875. German comparative philologist; prof. Berlin 1872. His most important services were in the department of Celtic.

Ebeling, CHRISTOPH DANIEL, 1741–1817. Prof. and librarian at Hamburg. *Geog. and Hist. N. America*, 5 vols., 1793–99.

Ebenaceæ. Natural family of flowering plants of the class *Angiospermæ*, sub-class *Dicotyledons*, and series *Gamopetalæ*, comprising 6 genera and ab. 250 species, distributed for the most part throughout the warmer regions of the earth; commonly called the Ebony family.

Eberhard, CHRISTIAN AUGUST GOTTLOB, 1769–1845. German poet. *Hannchen*, 1822; *The First Man*. 1828.

Eberhard, JOHANN AUGUST, D.D., 1739–1809. Prof. at Halle 1778. *New Apology of Socrates*, 1772; *Ethics of the Reason*. 1781; *Theory of Fine Arts and Sciences*, 1783. *Hist. Philosophy*, 1788; *Synonyms*. 6 vols., 1795–1802; *Manual of Æsthetics*, 4 vols., 1803–5.

Eberhard, KONRAD, 1768–1859. Bavarian painter and sculptor. Prof. Munich 1816.

Eberhard im Bart, 1445–1496. Founder Univ. Tübingen 1477; first duke of Würtemberg 1495.

Ebermayer, ERNST, b. 1829. Prof. Chemistry at Aschaffenberg and Munich, author of memoirs on Climate, Agriculture, and Forestry.

Ebers, GEORG MORITZ, b. 1837. German Egyptologist and novelist; Prof. at Jena 1868 and Leipzig 1870. *An Egyptian Princess*, 1864; *Uarda*, 1877; *Homo Sum*, 1878; *Serapis*, 1885; *Cleopatra*, 1894.

Ebert, ADOLPH, 1820–1890. Prof. Romance Languages at Leipzig 1862. *Hist. Mediæval Literature*.

Ebert, KARL EGON, 1801–1882. Bohemian poet and dramatist. *Wlasta*, 1829; *Am Bergsee*, 1879.

Ebionites. Jewish Christians who maintained that only observers of Judaism could be saved. They revered Jesus as a prophet.

Eblis. In the Koran, prince of evil genii or fallen angels.

Ebonite. Another name for vulcanite, produced by combining caoutchouc with half its weight of sulphur. Combs and similar articles are made from it. See CAOUTCHOUC.

Ebony. Hard, dark-colored wood produced by various trees of the genus *Diospyros*, natural family *Ebenaceæ*, natives of warm countries. Jamaica Ebony is derived from *Brya ebenus*, a tree of the Bean family. The best is *D. ebenum* from Ceylon, which yields logs 2 ft. diam. and 15 ft. long.

Ebony (*Diospyros ebenum*).

Ebrard, JOHANN HEINRICH AUGUST, D.D., Ph.D., 1818–1888. German Calvinist, Prof. at Zurich 1844 and Erlangen 1847–61. *Gospel History*, 1842, tr. 1863; *Apologetics*. 1874–75, tr. 1886–87.

Ebro. River of n. Spain, rising in the Cantabrian Mts. and flowing s.e. to the Mediterranean. Length 539 m.: drainage area 31,444 sq. m. On it the French defeated the Spaniards, Nov. 23, 1808.

Ebullioscope. Instrument devised for determining the strength of alcohol or other distilled liquids by observing the boiling point and the pressure. Those of Vidal and Conathy are the most accurate.

Ebullition. Production of vapor throughout the entire mass of a liquid through the agency of heat.

Ecardines (TRETENTERATA, LYOPOMATA, INARTICULATA). *Brachiopoda*, whose shell has no hinge nor brachial skeleton. The edges of the mantle-lobes are separate, and an anus is present. *Lingula*, a very ancient form, as shown by fossil remains, is a still living representative. It seems to have lived unchanged in form from the earliest fossiliferous ages to the present.

Ecbatana. Ancient capital of Media, near Mt. Orontes,

founded ab. 700 B.C.; summer residence of the Persian kings. Its great palace is mentioned by ancient authors.

Eccard, JOHANN, 1553–1611. Prussian composer, chiefly of chorals.

Ecce Homo. Type of paintings showing the Saviour's Head crowned with thorns; mainly unknown before 1600.

Ecce Homo, by Carlo Dolci, Pitti Gallery, Florence.

Correggio's painting is in a group, while Guido Reni's is the single head. The words signify "Behold the Man," and were spoken by Pilate, on presenting Jesus to the populace.

Eccentric. Not having the same or coincident centers; opposed to concentric.

Eccentric Angle. One formed at the center of an ellipse by the transverse axis and a line from the center to the point where the circumscribed circle meets the ordinate of the ellipse extended. If ϕ be the angle and x, y the co-ordinates of any point on the ellipse, we have the eccentric equations $x = a \cos \phi$ and $y = b \sin \phi$, where a and b are semi-axes.

Eccentricity, LINEAR. Distance from the center of a conic to one of its foci; usually represented by c.

Eccentricity, NUMERICAL (= e). Constant rates between the distance of points on a conic from its direction and the corresponding focus. In ellipse and hyperbola the numerical eccentricity is the ratio of the linear eccentricity to the semi-transverse axis ($= \frac{c}{a}$). In the ellipse $\frac{c}{a} < 1$; in the hyperbola $\frac{c}{a} > 1$.

Eccentricity, THEORY OF. Result of one of several attempts to find a cause for the cold of the Glacial Era or Ice Age. Its author, Dr. James Croll of Edinburgh, following a suggestion of Herschel, investigated the probable effect on climate of the actual secular variation in the eccentricity of the earth's orbit, whereby her distance from the sun varies from a minimum of 84,293,650 m. to a maximum of 98,506,350 m., involving a difference of 14,212,700 m. Dr. Croll believed that the result of this variation must be a great increase in the length of the winters and in the consequent accumulation of ice and snow about the Pole, whose winter occurred when the earth was furthest from the sun: to this accumulation he attributed the continental ice-sheet and the accompanying phenomena of glacial action.

According to this theory, an Ice Age must occur during every period of 21,000 years in times of high eccentricity. This period is determined by the precession of the equinoxes, which throws each hemisphere alternately into an aphelion position every 25,000 years, and by the retrograde motion of the perihelion point, which shortens this period to 21,000 years. Here has lain one of the greatest difficulties of the theory, in the opinion of many geologists, the evidence failing to establish during the Ice Age so rapid an alternation of glacial and temperate conditions.

Dr. Croll, following the calculations of Leverrier, places the Ice Age proper between 240,000 and 80,000 years ago, making its duration ab. 160,000 years, with two maxima of intensity. A previous similar era he places at the distance of 850,000 years ago in the Miocene, and a yet earlier one between 2,650,000 and 2,450,000, reckoning back from A. D. 1800. This, which he assigns to the Eocene, was, he says, the most severe of the three. A second difficulty is the inability of geologists to find traces of these cold eras in Miocene, Eocene, and earlier deposits, while a third is the impossibility of reconciling many post-glacial geologic phenomena, such as river gorges, etc., with a period so long as 80,000 years.

This theory has attracted great attention and led to much investigation, but it has failed to command general assent in face of the formidable difficulties involved.

Eccentricity of the Earth's Orbit. Distance of the focus from center divided by the semi-transverse axis. It changes slowly owing to the disturbing action of the planets. The present value is .0168. It will diminish for ab. 24,000 years, when the value will be .003. It will then increase for 40,000 years. The greatest value is .07.

Ecchendroma. Tumor consisting of cartilage.

Ecchymosis. Appearance caused by the escape of blood beneath the skin, or the blood itself.

Ecclesia. Assembly of Athenian citizens, meeting, under Solon's laws, 40 times annually.—In the Septuagint, the Jewish commonwealth; thence, in N. T., the Christian Church.

Ecclesiastes. Twenty-first O. T. book, written in the person of Solomon, as a discontented and skeptical pleasure-seeker, returning ultimately to faith in God and duty.

Ecclesiastical Commission. Created in England 1835, to examine and equalize Ch. revenues, and for similar purposes. It consists of the bishops, 3 deans, several judges, and 12 other laymen.

Ecclesiastical Modes. Octave sections of the fundamental scale of mediæval music (first space in the bass staff to third space in the treble without chromatics), constructed by the ch. musicians of the Middle Ages in imitation of the ancient Greek modes. According to tradition St. Ambrose established the first four, which were called Authentic: Dorian, D in the bass to d above; Phrygian, E in the bass to e above; Lydian, F in the bass to f above; Mixolydian, G in the bass to g above. To these four others, each beginning a fourth below and having the same name with the prefix hypo-, were added by St. Gregory. Two Authentic, Ionic and Æolian, and two plagal modes, Hypoionic and Hypoæolian, were added by later theoriticians. The scales thus formed were the basis of church music until supplanted by the modern system of major and minor keys.

Ecclesiasticus, or WISDOM OF JESUS THE SON OF SIRACH. Apocryphal book of maxims and reflections, often pithy and valuable; probably written in 3d century B.C.

Ecclesiology. Science of ch. building, furnishing, decoration, and antiquities pertaining thereto.

Ecderon. Epidermis, or outer layer of the ectoderm in Cœlenterates.

Ecdysis. Moulting; casting off of skin, hair, scales, shells, etc., periodically effected in certain animals, notably the *Crustacea*.

Ecgbert. See EGBERT.

Ecgonine. $C_9H_{15}NO_3$. Monobasic acid, produced by the decomposition of cocaine by hydrochloric acid; white crystalline solid.

Echarté. Game of cards, which originated in Paris early in this century, a development of an old game of La Triomphe or French Ruff. It is played by two persons, the small cards (2 to 6) being discarded. The cards rank from King downward, the Ace being above the Ten. Five cards are dealt to each player, two and three in succession, and the eleventh card turned for trumps; if it is a King the dealer scores one; also the king of trumps in hand must be announced before playing a card and counts one. The non-dealer either plays or calls for cards equal in number to his discard; the dealer may refuse or accede; and this may be repeated at pleasure. Two cards form a trick, and it must be taken by suit if possible; if the second player has not the suit, he must trump. The non-dealer, not calling for cards or the dealer refusing, must take three tricks, which scores one, or the adversary will score two. This rule applies only to the first call or refusal in each hand. Five tricks score two. The game is five. In dealing, the trump card is laid aside, and the cards following are dealt.

Echegaray, JOSE, b. 1835. Spanish dramatist, prof. at Madrid 1858, and thrice cabinet minister. *El Gran Galeotto*, 1881.

Echellensis, ABRAHAM, d. 1664. Syrian Maronite, who lived in Italy and France, and wrote a history of the Council of Nicæa.

Echelon. Subdivisions of a body of troops, placed one behind another, extending beyond and unmasking one another,

either wholly or in part. In battle formation, different lines in the direction of depth; *e.g.*, the firing line first, then the supporting line, the reserve being the last echelon.

Echeneis. See DISCOCEPHALI.

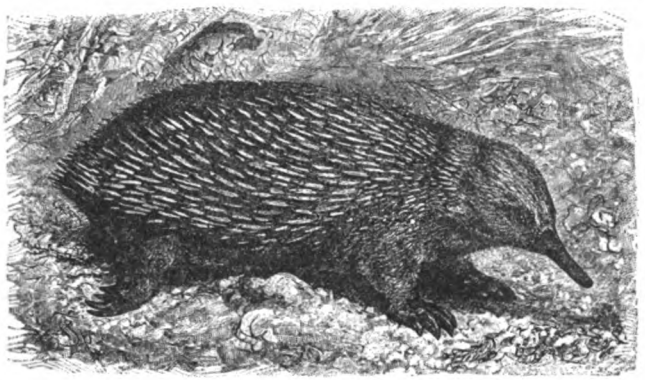
Echenique, JOSE RUFINO, 1808–1879. President of Peru 1851–55.

Echeverria, ESTEBAN, 1809–1851. Argentine poet.

Echeverría, FRANCISCO JAVIER, 1797–1852. Mexican Minister of the Treasury 1837–41.

Echevin. French official, chiefly municipal, 800–1789.

Echidna. One of the *Prototheria;* Australian mammal of the lowest order, having spiny fur, as in the Hedgehog, and a long, toothless snout and protrusible tongue, as in Anteaters.



Echidna.

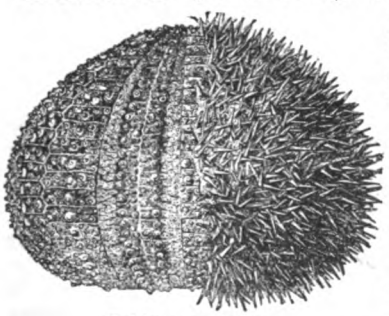
The feet are strongly clawed and adapted for burrowing as in Moles. It has a marsupial pouch, a cloaca and a coracoid bone, as in birds. It possesses two mammary glands, without nipples.

Echinococcus. Bladder-like structure, or embryonic form of *Tænia echinococcus*, a tape-worm infesting dogs, within which are secondary bladders containing immature worms; found in the tissues of men and animals that have accidentally taken into their system the eggs discharged with the fæces of the host of the mature animal. It may be of large size and destroy life by pressure. It is extremely common in Iceland, from 2 to 3 per cent of the population being affected, owing to keeping large numbers of dogs. See TÆNIA ECHINOCOCCUS and TÆNIADÆ.

Echinoderes. See NEMATORHYNCHA.

Echinodermata. Animals with a radial pentamerous structure. They possess a skin hardened by calcareous deposits, a true body cavity surrounding a digestive canal, a water-vascular system and also a true vascular system. This sub-kingdom of animals includes the classes *Blastoidea*, *Cystoidea*, *Crinoidea*, *Echinoidea*, *Asteroidea*, *Ophiuroidea*, and *Holothuroidea*.

Echinoidea (SEA-URCHINS). Group of Echinoderms, including forms that are globular, heart-shaped or disk-shaped, with a stiff shell, composed of calcareous plates, arranged in meridional rows. Usually there are twenty rows in all, two to each ambulacral and each interambulacral zone. A mouth and an anus are present. The abactinal surface is reduced to a small area at the aboral pole. The sexes are separate. The group embraces two divisions, *Euechinoidea* and *Tessellata*. The former includes the irregular Sea-Urchins (*Exocyclica*), and the regular Urchins (*Endocyclica*).



Echinus esculentus.

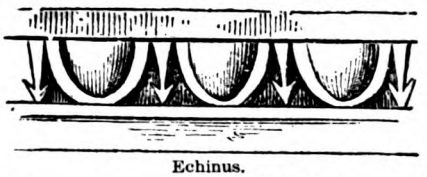
Echinopædium. Larva (or pluteus) of Echinoderms in its later stages, when the adult form is developing in it.

Echinorhynchus. Genus of *Vermes*, including many species, parasitic on the walls of the intestine of Crayfishes, Fishes, Birds, and Mammals, as the Pig; rare in Man. See ACANTHOCEPHALA.

Echinothuridea. See ENDOCYCLICA.

Echinozoa. Section of *Echinodermata*, including the classes *Asteroidea*, *Echinoidea*, and *Holothuroidea*.

Echinus. In Grecian architecture a convex molding, the same as ovolo, often covered with a carving of alternating "egg



Echinus.

and dart," a name commonly applied to the molding itself thus enriched.

Echiuroidea (ECHIURIDÆ). See CHÆTIFERA.

Echo. Repetition of any sound caused by its reflection from some obstacle. A certain least distance from the source of sound to the reflecting surface is obviously necessary for the production of an echo. For the repetition of a monosyllable about 42 meters is required, and with this as a basis the distance is proportional to the number of syllables or distinct sounds successively produced. Reflecting surfaces in some cases have been so arranged, either by nature or artificially, that the original sound is repeated many times, thus producing multiple echoes.

Echo. Nymph who used to engage Juno's attention when Jupiter was sporting with the Nymphs; changed to an echo when Juno discovered the trick. She fell in love with Narcissus, who did not return her passion, and pined away to a mere voice.

Echolalia. Repetition of another's words; symptom of disease of brain.

Echthyma. Affection of the skin, usually in badly nourished, unhealthy, or dirty individuals, consisting of small isolated pustules.

Eck, LEONARD, 1480–1550. Celebrated jurist, high in the

Leonard Eck.

confidence of Charles V. It was said of him that what was settled without his advice was settled in vain.

Eck or **Mayer,** JOHANN, D.D., 1486–1543. Prof. at Ingolstadt from 1510; active opponent of Luther, in disputation at Leipzig 1519; Papal Nuncio. His life was spent in efforts to overthrow the Reformation.

Eckermann, JOHANN PETER, 1792–1854. Friend and editor of Goethe. *Conversations with Goethe*, 1836, tr. 1839 and 1850.

Eckersberg, JOHAN FREDERIK, 1822–1870. Norwegian painter, founder of an art school at Christiania 1859.

Eckersberg, KRISTOFFER VILHELM, 1783–1853. Danish painter and teacher.

Eckert, THOMAS THOMPSON, b. 1825. Head of U. S. military telegraph dept. 1862–65; Pres. Atlantic and Pacific Co. 1875, American Union Co. 1880, and Western Union Co. 1893.

Eckfeldt, JACOB REESE, 1803–1872. Assayer U. S. Mint Phila. 40 yrs. With his assistant and successor, WM. E. DUBOIS, 1810–1881, he pub. a book on coins, 1860.

Eckhart, ab. 1260–1327. German pantheistic mystic; Dominican monk, vicar of the order at Erfurt and vicar-general in Bohemia; teacher at Paris and Strassburg; a great thinker, preacher, and administrator. Some of his opinions were condemned by the Pope after his death.

Eckhel, JOSEPH HILARIUS, 1737–1798. Austrian numismatist, Prof. Univ. Vienna and keeper of the imperial cabinet of coins. His *Doctrina Nummorum Veterum*, 8 vols., 1798, was the chief work of its kind to that date.

Eckmühl. Village of Bavaria; scene of Napoleon's victory over the Archduke Charles of Austria, April 22, 1809.

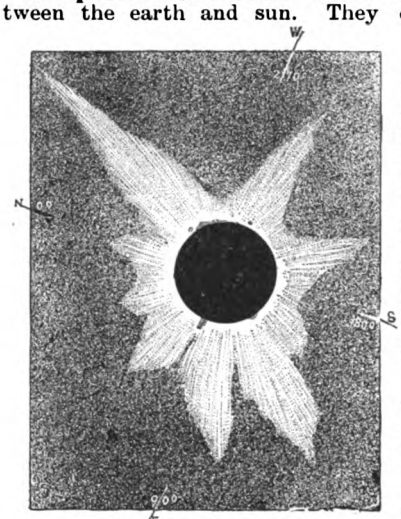
Eclampseà. Attack of convulsions, especially when not due to disease of brain.

Eclecticism. Method of forming philosophic systems by selection of the better elements from several varying schools or sources; familiar since Plato, though the term is of later origin.

Eclectics. Members of a school of medicine, followers of which assume to select the best from varying systems.

Eclipses of the Moon. Caused by the moon passing through the shadow of the earth at the time of full moon. They can occur only when the sun is near a node of the moon's orbit. Not more than two lunar eclipses occur in one year, and frequently there are none.

Eclipses of the Sun. Caused by the moon passing between the earth and sun. They can occur only at the time of new moon and when the sun is near one of the nodes of the moon's orbit; there cannot be less than two or more than five in one year. The eclipse may be total, annular, or partial, according as the disk of the moon entirely covers the sun, leaves a ring around the edge, or passes to one side of the center so as to cut off only a portion of the sun's light.



Eclipse of 1868. (Corona.)

Ecliptic. Great circle formed by the intersection of the plane of the earth's orbit with the celestial sphere.

Ecliptic Limits. If full moon occurs when the sun is within 9° 30′ of the moon's node, an eclipse of the moon must take place. If the distance is greater than 12° 5′, an eclipse is impossible. The former is called the minor, the latter the major, ecliptic limit. Similarly, if new moon occurs when the sun is within 15° 21′ of the moon's node, a solar eclipse is inevitable; if the distance is greater than 18° 31′ it is impossible.

Eclogue. Pastoral poem, usually in dialogue; *e.g.*, those of Virgil, Petrarch, and Spenser.

Ecnomus. Hill on s. coast of Sicily; scene of signal defeat of Agathocles of Syracuse by Carthaginians 311 B.C. Near it Regulus conquered the Carthaginians 256 B.C. in a great naval battle, in which 680 ships were engaged and 300,000 men.

Economic Coefficient. Ratio of useful electric energy realized in an external circuit to the total amount developed by the machine; often called electrical efficiency. See EFFICIENCY.

Economic Freedom. Characteristics of modern industrial organization; especially the business habits of self-reliance and independence, deliberation and forethought, and an accompanying extension of the sphere of competition.

Economic Harmony. Supposed law that whatever is best for one's self in economic activity is best for others also, free competition harmonizing interests and distributing burdens equably.

Economic History. That department of history which is concerned with agriculture and landholding, manufacture and industrial organization, money and the processes of exchange, and other elements in the economic life of nations.

Economic Laws. Statements of the economic results that follow from known physical facts, or of the course of action that may be expected under certain conditions from the members of an industrial group.

Economic Man. Man as subjected only to self-regarding motives, supposed alone to be constant and invariable in their action. By referring all economic processes to human beings of this suppositious nature, a hypothetical character was given to all conclusions, which, if remembered, decreased their value and interest; if forgotten, as was generally the case, it made them untrue to real life.

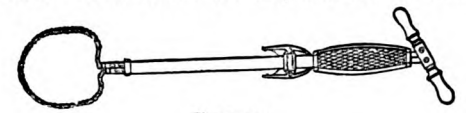
Economic Motives. Motives to action in the sphere of the creation, exchange and consumption of wealth, whose intensity can be measured, and whose action is sufficiently regular to be reduced to law.

Economistes. School of French economic writers of the last century, following upon the mercantile school, and laying almost exclusive stress on the importance of agriculture in the production of wealth. It included Quesnay, Turgot, and the elder Mirabeau. They were also called the Physiocrates.

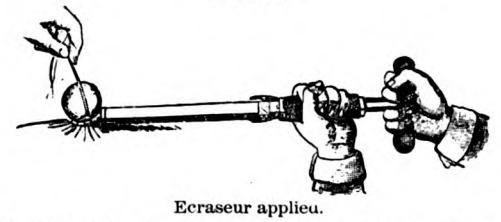
Ecorcheurs. Bands of highwaymen who ravaged France and Belgium ab. 1422–61.

Ecoutes. Small galleries excavated beyond the glacis toward the siege-works for the purpose of listening to the besieger's progress.

Ecraseur. Instrument for amputation. It consists of a



Ecraseur.



Ecraseur applied.

loop of chain, cord, or wire, which is passed around parts to be removed, and slowly tightened.

Ecstasy. Condition in which a person is oblivious of his surroundings, the vital processes being more or less depressed; often a manifestation of hysteria.

Ecthyma. Disease of the skin in which isolated pustules with a hard base in the center of a reddened inflamed patch occur upon various parts of the body; usually due to bad nutrition or syphilis.

Ectoblast. See EPIBLAST.

Ectocarpaceæ. Order of small green or brown marine or fresh-water *Algæ*, including eight families and a large number of genera and species.

Ectochone. See SUBDERMAL CHAMBERS OF SPONGES.

Ectocyst. External cup or investment of a Polyzoön.

Ectoderm. Epiblast; outermost of layers into which nearly all fecundated ova divide, from which are developed the central nervous system, the organs of special senses, skin and mucous membrane of the mouth and anus. External integument of Cœlenterates.

Ectogenic. Organisms normally parasitic in the tissues of plants or animals, but capable of independent existence.

Ectolecithal. Eggs of spiders, etc., in which the yolk is on the surface and the nucleus segments in the interior.

Ectolithia. See RADIOLARIA.

Ectoparasite. Parasite which (like the louse) lives on the outside of the body.

Ectoplasm. Transparent layer of protoplasm which lines the interior of vegetable cells. See also ECTOSARC.

Ectoplastic Tissues. Those formed by deposits in the cell-wall or in the intercellular spaces of the primitive blastema.

Ectoprocta. *Bryozoa*, with anus opening outside the circle of tentacles. Two sub-orders are included, the *Phylactolæmata* and *Gymnolæmata*.

Ectopterygoid. External piece of the pterygoid bone of Fishes.

Ectosarc, or ECTOPLASM. Outer transparent and firmer layer of the cell body in Rhizopods and other *Protozoa*.

Ectospore. See BASIDIOSPORE.

Ectostosis. Ossification of cartilage into bone, proceeding from without inward.

Ectostracum. Layer beneath the epiostracum of the crab's shell.

Ectotheca. Outer layer of the wall (or perigonium) of the sporosacs of Hydroids.

Ectropion, or ECTROPIUM. Eversion of the margin of a part; usually applied to turning out of the edge of the eyelids.

Ecuador. Republic of S. America, s. of Colombia; area 108,082 sq. miles. The w. part is occupied by the high ranges of the Andes, which extend nearly to the Pacific coast. The e. part is a densely forested plain, drained by the upper waters of the Amazon. The capital is Quito. E. was freed from Spain 1821. Together with New Granada and Venezuela it formed the United States of Colombia, which was dissolved

in 1832, when it became an independent republic. It was originally the kingdom of Quito, whose history is supposed to extend back to the 3d century. From ab. 1735 to 1822 it was a dependency of Peru under the dominion of Spain. It was embroiled for many years in civil wars and in conflicts with Peru, and was visited by a severe earthquake 1868, in which 30,000 persons are said to have perished. Pop., 1892, ab. 1,270,000, mostly Indians or of mixed blood.

Eczema. Disease of skin with formation of popules or vesicles, which burst, leaving an itching and burning surface, usually covered with a crust. Also called Salt Rheum. Zinc ointment containing calomel is a remedy.

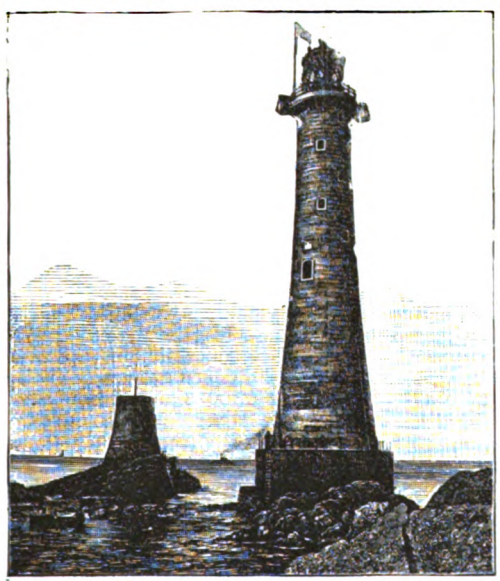
Edam. Netherland town 12 m. from Amsterdam, famous for its cheeses, which are largely exported. Pop., 1890, 5,880.

Edda, THE ELDER. Collection of Old Norse lays in two groups, Mythic and Heroic, treating of gods and heroes; dating probably from 900–1300.

Edda, THE YOUNGER. Collection of Old Norse literature ascribed to Snorri Sturluson, 1178–1241, but in part revised or composed by different persons. It treats in part of a visit to Asgard, but mainly of the art of poetry and the Old Norse meters.

Eddy Currents. Short local currents set up in the iron masses of dynamo electric machinery; according to the law of Lenz, they absorb a part of the energy expended in running the machine. The usual way of preventing them is to construct the parts affected, viz., the pole pieces and the armature cores, of laminæ built up so that the mass of the iron is divided by planes in a direction perpendicular to the direction of the electromotive forces tending to start the eddies.

Eddystone. Cluster of rocks only visible at low tide ab. 14 m. s. s.w. of Plymouth, England. Numerous wrecks led to the erection of a lighthouse here 1696 by Winstanley, who perished with it in the great storm of 1703. A second wooden



The New Eddystone Lighthouse.

structure was burned 1755, and a third was partially dismantled 1882 on account of the sea having undermined its base. A new one was built on another part of the reef and half the old one was left standing. The light is at a height of 133 feet, 159,600 candle-power, and visible 17½ m.

Edelinck, GERARD, 1649–1707. Dutch engraver, who excelled both in figure and portrait engraving; very successful in reproducing the works of Raphael and Le Brun. His portrait work is also very fine. He handled the graver with exceeding skill and refinement.

Edelmann, MAX THOMAS, b. 1845. Prof. Munich; founder of a workshop for physical apparatus; specialist in magnetism.

Edelweiss. *Leontopodium alpinum.* Alpine plant found in the higher valleys, having flowers of a peculiar woolly texture and much sought by tourists for its beauty and rarity.

Eden. Paradise inhabited by our first parents; conjecturally placed in various parts of Asia; probably in Babylonia.

Edentata (BRUTA). Order of adeciduate *Placentalia*, having the teeth incomplete or absent. The grinders are generally present, but are rootless and not coated with enamel. The feet have curved claws. The animals here included are sluggish and stupid, and are confined to the southern hemisphere. Those that live on plants constitute the group *Phytophaga*, including *Megatherium* and *Bradypodidæ;* those that feed on insects form the group *Insectivora*, including *Vermilinguia* and *Loricata.*

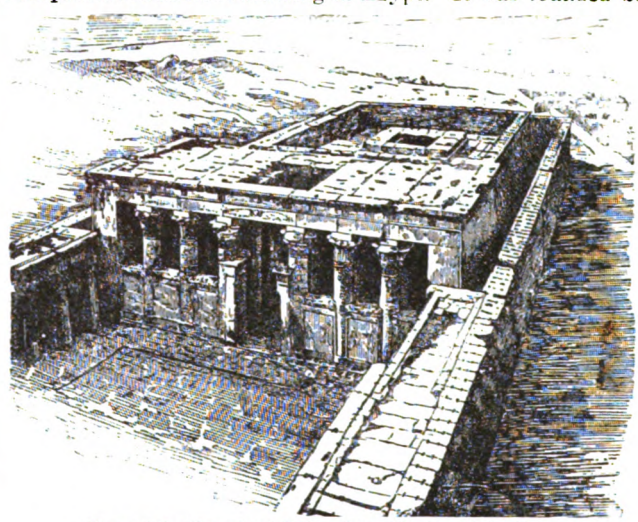
Edentula. See VERMILINGUIA (*Edentata*) and CARPOPHAGA.

Edersheim, ALFRED, D.D., Ph.D., 1825–1889. Austrian Jew, who became a minister of the Scottish Free Ch. 1849, and an Anglican 1875. *Home and Synagogue*, 1872; *The Temple*, 1874; *Bible History*, 8 vols., 1875–87; *The Messiah*, 1883–85.

Edessa. Ancient name of Orfa in n. Mesopotamia, identified by tradition with Ur of the Chaldees, also called Callirrhoe; capital of Osrhœne 135 B.C.–A.D. 217. Christianity took root here by 200. In 5th century it is said to have contained more than 300 monasteries. It was a chief seat of oriental learning, and famous for its schools of theology; was taken by Baldwin de Bouillon 1097, by Byzantines 1234, by Tamerlane 1393, by Turks 1637. Pop. 40,000—Also a city of Macedonia, long a royal burial place, previously named Ægæ.

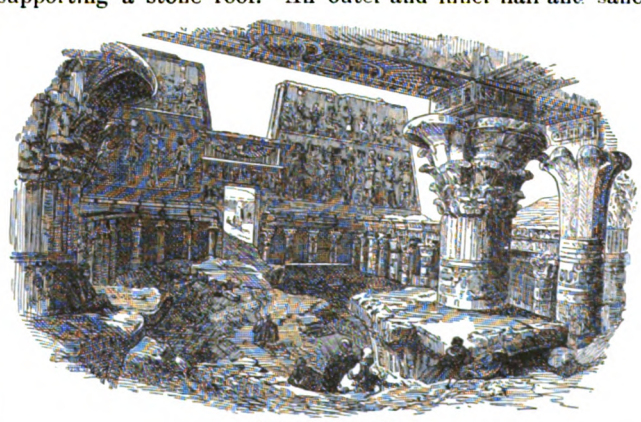
Edestus. Immense dorsal spine of a fish, probably allied to the Rays; composed of solid bone and having the upper margin set with large, triangular, crenulated, enameled teeth, occurring in the coal measures of Ind., Ill., and Ark.

Edfou, or EDFU. Egyptian village on the Nile, lat. 25° N.; site of a temple of the Ptolemaic period which ranks as the best preserved ancient building in Egypt. It was founded 200



View of the Temple at Edfou, from the top of the Pylon.

B.C. It is 451 feet by 250. The gateway is 50 feet high and the court beyond 161 feet by 140, and inclosed by 32 columns, supporting a stone roof. An outer and inner hall and sanc-



Entrance Court.

tuary have stone roofs, and the outer walls of these are covered with ecclesiastical inscriptions. See ARCHITECTURE.

Edgar, 944–975. King of Northumbria and Mercia 959, and of Wessex 959. His reign was marked by prosperity and progress.

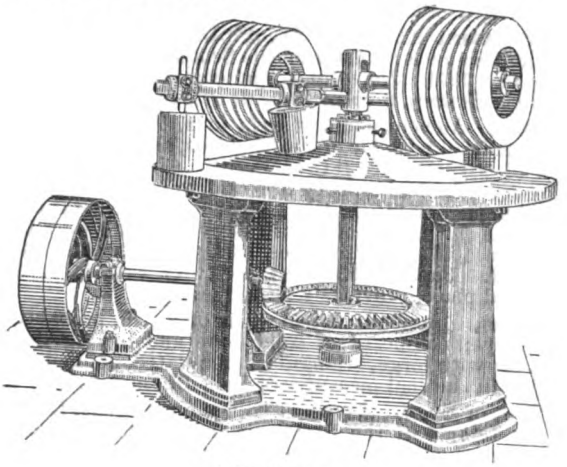
Edgar the Atheling, b. ab. 1057. Titular successor of Harold 1066; driven to Scotland and engaged in revolts; prisoner 1106.

Edge. Line of intersection of two planes forming a dihedral angle.

Edgehill. In Warwickshire, Eng.; scene of the first important action of the civil war, between royalists under Rupert and parliamentary army under Essex, Oct. 23, 1642.

Edge-Runner. Ore-grinding apparatus, in which the

work is accomplished by the rolling on edge of heavy broad-faced wheels of stone or iron.



Edge Runner.

Edgewater. Village of Staten Isl., Richmond co., N. Y. Pop., 1890, 14,265.

Edgeworth, HENRY ESSEX, 1745–1807. Irish priest, confessor of Louis XVI., whom he attended to the last. *Memoirs*, 1815; *Letters*, 1818.

Edgeworth, MARIA, 1767–1849. Irish novelist. *Castle Rackrent*, 1801; *Belinda*, 1803; *Popular Tales*, 1804; *Leonora*, 1806; *Tales of Fashionable Life*, 1809–12; *Patronage*, 1814; *Ormond*, 1817; *Helen*, 1834; besides books for children.—Her father, RICHARD LOVELL, 1744–1817, an inventor, bore part in her first writings, *On Education*, 1798, and on *Irish Bulls*, 1801.

Edgreen, ANNA CHARLOTTA (LEFFLER), 1849–1892. Swedish novelist and dramatist, m. 1872; Duchess Caianello of Naples 1890.

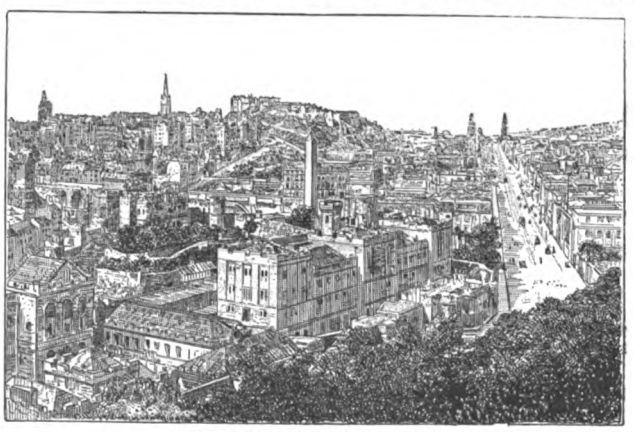
Edhem Pasha, b. 1823. Turkish Minister of Foreign Affairs 1867; ambassador to various governments; Grand Vizier 1877; Minister of the Interior 1883–85.

Edict. Ordinance of a Roman prætor or other magistrate, supplementing the civil law; later, decree of a prince.

Edict of Nantes. Proclaimed April 13, 1598, by Henry IV., granting partial toleration to the Huguenots; revoked Oct. 17, 1685.

Edible Bird's Nests. Made by ten species of the genus *Collocalia*, of the Swift family. They inhabit Madagascar, s.e. Asia and the E. Archipelago, breed in caves and build their nests of a mucous secretion, highly prized as a table delicacy by the Chinese and other Asiatics.

Edinburgh. Capital of Scotland since 1437; s. of Firth of Forth; fortified by King Edwin ab. 617; sacked by the English 1544 and 1650. The Old Town is called "Auld Reekie," from the smoke and filthy streets, but is picturesque both in situation and architecture. It contains a castle, palace, parliament house, university and two cathedrals, and is important as a literary and governmental center. The New Town is well laid out, with handsome streets and buildings. Pop., 1891, 261,261.



Edinburgh, from Calton Hill.

Edinburgh, UNIVERSITY OF. Founded 1582. It has faculties of Arts, Divinity, Law, and Medicine, with 41 professors, and a library of 150,000 vols.

Edinburgh Review. Started Oct. 1802 by Jeffrey, Sidney Smith, F. Horner, and Brougham; edited by Jeffrey 1803–29, and then by M. Napier; Whig in principle, and eminent for ability and wit. Macaulay was a frequent contributor.

Edingtonite. Rare mineral found near Glasgow in very small crystals that illustrate one of the types of hemihedrism in the tetragonal system. Hydrous silicate of aluminium and barium.

Edison, THOMAS ALVA, Ph.D., b. 1847. American electrician, inventor of the phonograph and many other instruments; patentee of some 500 devices, over 100 relating to telegraphy. His laboratory was at Newark, N. J., 1871–76, then at Menlo Park, and now at W. Orange, N. J.

Edlund, ERIK, 1819–1888. Prof. of Physics in Univ. Stockholm; author of many investigations bearing on atmospheric electricity, the aurora, and earth currents.

Edmeston, JAMES, 1791–1867. English hymnist.

Edmund I., "THE MAGNIFICENT," ab. 922–946. King of the West Saxons and Mercians 940; conqueror of Cambria.

Edmund II., "IRONSIDE," 989–1016. King of the West Saxons; rival of Canute.

Edmund, ST., 840–870. King of East Anglians (in Norfolk and Suffolk) 855; tortured and beheaded by heathen Danes.

Edmund, ST. (RICH), ab. 1170–1240. Abp. of Canterbury 1234; canonized 1247.

Edmunds, GEORGE FRANKLIN, LL.D., b. 1828. U. S. Senator from Vt. 1866–91.

Edom. Country s.e. of Palestine, occupied by a tribe tracing descent from Esau; ab. 130 B.C. forcibly incorporated with the Jews, over whom they set the Herodian family.

Edred. King of the English 946–955; brother and successor of Edmund I.

Edriophthalma. See CYCLOBRANCHIATA.

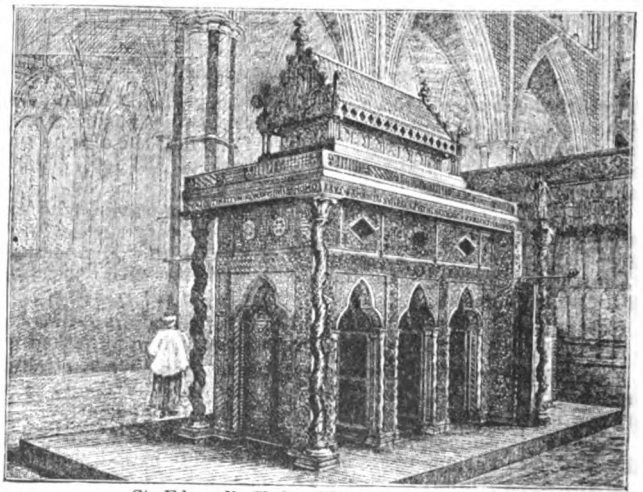
Edriophthalmata (SESSILE-EYED CRUSTACEA). Division of *Malacostraca*, including the *Læmodipoda*, *Amphipoda*, and *Isopoda* (also called *Edriophthalma* and *Hedriophthalmata*). See ARTHROSTRACA.

Edris. Syrian name for a variety of games played with men upon boards, of which one, the Edris a jin or "Edris of the Genii," of the Druses of Lebanon, played upon a complicated cross-shaped board, may be regarded as one of the connecting links between the game of Pachisi and Chess.

Edrisi, ab. 1100–1180. Arabic geographer, settled in Sicily. His *Book of Roger*, 1154, was tr. into Latin 1619 and into French 1836–40.

Education. Art of developing the moral, physical, and intellectual faculties of man. In the ancient republics the State prescribed the necessary education; in the Middle Ages it was left to the Church, and modern governments have again taken charge. See COMMON SCHOOLS and COMPULSORY EDUCATION.

Edward the Confessor, 1004–1066. King of England 1042–66; son of Ethelred II. He succeeded his half-brother Hardicanute, and was followed by Harold. He rebuilt the Abbey Church of Westminster, where the remains of his splendid shrine are still to be seen, and was canonized 1161.



St. Edward's Shrine, Westminster Abbey.

Edward I., "LONGSHANKS." 1239–1307. King of England 1273, succeeding his father, Henry III., after engaging in the 7th Crusade. He subdued Wales 1282, drove the Jews from

England 1290, and invaded Scotland 1296 and 1303. The first parliament was summoned in his reign 1295.

Edward II., 1284–1327. King of England 1307; son of Edward I.; first Prince of Wales 1301; defeated by Scots under Bruce at Bannockburn 1314; at odds with the barons; imprisoned and murdered.

Edward III., 1312–1377. King of England 1327; son of Edward II. He defeated the French at Crécy 1346, reduced Calais 1347, and by his son, the Black Prince, gained the battle of Poitiers 1356, but later lost nearly all his French possessions.

Edward IV., 1442–1483. Son of Richard, duke of York; King of England March 4, 1461, after defeating the Lancastrian Henry VI.; expelled by Warwick 1470. He regained the throne, and ended the War of the Roses at Tewkesbury, May 4, 1471.

Edward V., 1470–1483. Son and successor of Edward IV.; murdered with his brother in the Tower by their uncle, Richard III.

Edward VI., 1537–1553. King of England Jan. 28, 1547; son of Henry VIII. and Jane Seymour; favored the Reformation; repealed the "Bloody Statute"; executed his uncles Seymour and Somerset, and endeavored to exclude his sisters and to appoint Jane Grey his successor.

Edward, Prince of Wales, 1330–1376. See Black Prince.

Edward, Thomas, 1814–1886. Scottish naturalist; shoemaker at Banff.

Edwards, Amelia Blandford, LL.D., L.H.D., 1831–1892. English novelist and Egyptologist; founder Egyptian Exploration Fund. *My Brother's Wife*, 1855; *Barbara's History*, 1864; *Debenham's Vow*, 1870; *A Thousand Miles up the Nile*, 1877; *Pharaohs, Fellahs, and Explorers*, 1892.

Edwards, Bela Bates, D.D., 1802–1852, Prof. at Andover from 1837; ed. *Bibliotheca Sacra* from 1844.

Edwards, Bryan, 1743–1800. Historian of the British W. Indies 1793–94, and of St. Domingo 1797.

Edwards, Henri Milne. See Milne-Edwards.

Edwards, Jonathan, 1703–1758. Theologian and metaphysician, pastor at Northampton, Mass., 1727–50; Pres. Coll. N. J. 1758. In his *Freedom of the Will*, 1754, *Original Sin*, 1758, and other treatises he presented Calvinism in a somewhat modified form, urging "determinism" as opposed to "necessitarianism" in volition. His doctrines were all powerful in New England for some time and changed the prevalent conception of free will.—His son and namesake, 1745–1801, Pres. Union Coll. 1799, edited his works and wrote on *The Atonement*, 1785.

Edwards, Matilda Barbara Betham. See Betham-Edwards.

Edwin. King of Northumbria 617–634, overlord of Britain except Kent; founder of Edinburgh.

Eeckhout, Gerbrand, 1621–1674. Dutch painter and etcher.

Eel. *Anguilla acutirostris.* The common eel lives in the

Eel (*Anguilla anguilla*).

North Atlantic and its rivers. The sexes do not differ externally. The male reproductive organs (spermaries) differ from the ovaries in being narrow and lobulated. Eggs when ripe are visible to naked eye, and a six-pound eel will produce nine millions at a spawning. Female eels descend rivers to lay eggs in brackish water, where the males arrive in early winter. The males rarely go into fresh water. It is a popular error that the Lamper Eel is the "mother of eels." The Lamprey (q.v.) belongs to a different class of Vertebrates. The Electric Eel belongs to a different order of Fishes.

Eel-Grass. *Zostera marina.* Marine aquatic grass-like plant of the Pondweed family, of very wide geographical distribution; known also as Grass-wrack. Also *Vallisneria spiralis*, a plant of similar appearance, inhabiting streams in the northern hemisphere; known also as Tape-grass.

Effect. That which is produced by a real or supposed cause; also a consequence, or event accomplished or purposed.

Effects. Property of every description, unless limited by context in statutes.

Effendi. Turkish title of respect signifying Master. It is particularly subjoined to the names of savants and ecclesiastics.

Efficiency. The efficiency of any machine is the ratio of the energy the machine delivers to the amount it absorbs. Several kinds may be distinguished; *e.g.*, the gross efficiency, or simply its efficiency as an energy-converter, and the net efficiency, or the ratio of the useful energy available to the total amount consumed. In the case of the dynamo, the ratio of the energy of the electric current in the circuit to the energy absorbed by the dynamo is sometimes called the efficiency of electric conversion. The whole of this electric energy cannot be utilized; the ratio of the useful part realized in the external circuit to the total amount developed by the machine is called the electrical efficiency, or by Thompson the Economic Coefficient (q.v.).

Efficiency Earnings. Earnings measured, not as time-wages are by the time spent, nor as piece-wages are, by the amount of output resulting from the work, but with reference to the exertion of ability required of the worker. The tendency of such different forms of earnings in any one district is toward equality, so long at least as complete economic freedom exists.

Efficiency of Labor. See Industrial Efficiency.

Efflorescence. Crystalline compounds containing water of crystallization, which they lose on being exposed to the air, fall to powder and exhibit this.—In Botany, phenomena of the flowering of plants.

Effort. See Volition.

Effusion. Passage of a gas into a vacuum through a very minute aperture in a thin plate of metal or glass. The velocity of efflux follows Torricelli's law; viz., $v = \sqrt{2gh}$, in which h represents the pressure expressed in terms of the height of a column of the gas that would exert the same pressure by its weight.

Egalité. Name taken 11th Sept. 1792 by Louis Philippe Joseph, Duke of Orleans, 1747–1793. He opposed the Court and voted for the death of Louis XVI. In spite of pandering to the mob he himself was guillotined.

Egan, Maurice Francis, b. 1852. American poet and novelist; ed. *Freeman's Journal*, 1881; prof. Univ. Notre Dame, Ind., 1888.

Egan, Pierce, 1772–1849. English humorist and author of sporting novels. *Boxiana; Life in London.*—His son and namesake, 1814–1880, was also a novelist.

Egana, Juan, 1767–1836. Chilian patriot; prolific author.

Egbert, 802–836. King of Wessex. He subjected Mercia and Northumbria, laid the foundation of English national sovereignty, and defeated the Danes 835.

Egede, Hans, 1686–1758. Norwegian Lutheran, apostle of Greenland, where he labored 1721–40 with great success, continuing his superintendence after his return to Europe. He wrote two books, 1729–38, on the country and the mission. His work was continued by his son Povel, who prepared an Esquimaux dictionary, grammar, and Testament, 1750–60–66.

Eger. Ancient town of n.w. Bohemia. Here the Emperor Sigismund attempted to establish peace in Germany 1437, and Wallenstein was murdered 1634. The Swedes took it 1631 and 1647, and the French 1742.

Egeria. Roman nymph or muse, who instructed Numa Pompilius respecting institutions and forms of worship.

Egerton, Francis Leveson Gower, 1800–1857. English statesman and author; created Earl of Ellesmere 1846.

Egerton, George. See Clairmonte, Mrs.

Egerton, Sir Philip Grey, 1806–1881. Student and collector of fossil fishes, many of which were described by Huxley. His writings throw valuable light on the structure and affinities of fossil fishes and reptiles.

Egesta. Waste products of the body.

Egg. Reproductive cell of a female organism. It differ-from the male germ-cell in being non-motile and in having much greater size, due mainly to the quantity of yolk stored up in it as food for the embryo. Reptiles and birds add a layer of "white" or albumen around the true egg ("yolk") and inclose the whole by a porous shell of lime salts, overlying two membranes between which, at the large end, an air space forms as the fluids evaporate or the contents are used by the developing young. The Mammalian egg having no "white" and little yolk is of microscopic size, except in the DUCK-MOLE (q.v.). The eggs of many of the Insects (Plant-lice) and *Crustacea* (*Daphnia*), etc., can develop without being impregnated; such eggs are "parthenogenetic." The female oyster may spawn as many as fifty million eggs in one season. This great number is required because of the small chance there is of impregnation occurring in the environing water. For a similar reason most fishes have great numbers of eggs. The amount of eggs used in the arts withdraw a large amount of food from the market. Egg albumen is used by calico printers for fixing better and lighter sorts of colors. It is also used for photographer's paper and for clarifying vinous and syrupy liquors, for upon being heated it coagulates and envelops the substances which it is desired to remove. The yolk is used in an emulsion for tanning leather used in the manufacture of kid gloves; the yolk acting by the oil it contains, this oil giving the leather suppleness and softness.

Egg-Bird. *Sterna fuliginosa.* Sea bird of the Gull family. It has black and white plumage and breeds principally in the W. Indies, laying only one egg, which is highly esteemed for the table. Egg-gathering is the chief occupation of many natives.

Eggleston, EDWARD, b. 1837. American novelist, biographer of Tecumseh, 1878, and other Indians. *Hoosier Schoolmaster.* 1871; *Roxy,* 1878; *History U. S.,* 1888; *The Faith Doctor,* 1891.—His brother, GEORGE CARY, b. 1838, ed. N.Y. *Advertiser* 1886–89, has pub. *A Rebel's Recollections,*1874; *Juggernaut,*1891, and other books.

Egg-Plant. *Solanum melongena.* Coarse herb of the Potato family, native of S. America; widely cultivated for its large, edible fruit.

Eginhard, or EINHARD, ab. 770–840. Secretary and biographer of Charlemagne, but not his son-in-law, as the legend has it. His *Annales Francorum, 741–829,* were tr. into French and German, and his Letters into French, 1848.

Eglantine. Several wild species of rose, in Europe. Also *Rubus eglanteria,* a European bramble.

Egleston, THOMAS, Ph.D., LL.D., b. 1832. Prof. Columbia Coll. 1864; pres. Inst. Mining Engineers 1886. *Metallurgical Tables,* 1869; *Mineralogy,* 1871; *Metallurgy of Gold and Silver,* 1887.

Eglinton and Winton, ARCHIBALD WILLIAM MONTGOMERY, EARL OF, 1812–1861. Reviver of tournaments, 1839.

Egmont, LAMORAL COUNT D', PRINCE DE GAVRE, BARON DE FIENNES, 1522–1568. General of cavalry at St. Quentin 1557, and at Gravelines 1558; Gov. of Flanders and Artois. He supported the Catholic party, but favored moderate measures. After Alva's arrival he with Horn was treacherously seized, tried for treason, and beheaded June 5, 1568.

Lamoral Count d'Egmont.

Ego. See SELF.

Egoism. Ethical theory which determines the value of conduct by reference to its effect upon the agent alone; generally identified with selfishness.

Egoistic Hedonism. System of morals that fixes as the reasonable ultimate end of each individual's action his own greatest possible happiness.

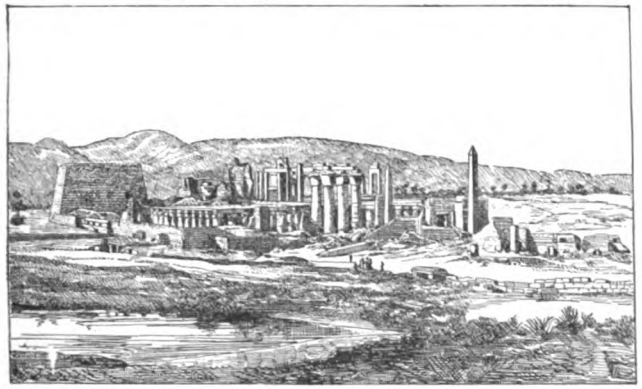
Egret. See HERON.

Egypt. Country of n. e. Africa. Of its great area the only habitable region is the valley of the Nile, which by its annual floods waters and fertilizes a narrow belt; the rest of the country is an arid desert. The principal crops are the cereals, cotton, sugar, and tobacco. It has a large trade with the interior of Africa and considerable commerce. Pop. 6,817,265, mainly Arabs. The capital is Cairo, the principal city and port Alexandria. Menes, founder of the first dynasty, whose date is variously assigned from 5702 to 2000 B.C., is said to have instituted laws and worship. In this dynasty were built the pyramids at Ko. The next dynasty, lasting ab. 300 years, introduced the worship of sacred animals. With the third, a Memphite dynasty, monumental history begins. The Khufus, who erected the two great pyramids at Gizeh, and Cheops, builder of the largest pyramid, belonged to the 4th, also a Memphite dynasty. Other pyramids were built during this and the succeeding dynasty, which was from Elephantine, and reigned in both Upper and Lower E. Civilization was now somewhat advanced. Many remains exist from the sixth, a Memphite dynasty, to which Nitocris belonged. Of succeeding dynasties little is known till the eleventh, but it is supposed that there were two lines of contemporary kings, in Upper and Lower E. In the sixth year of Osirtesen II., 4th king of the twelfth dynasty, a band of 36 Semites arrived in E., which may have been the family of Jacob. The next king, Amenemha III., excavated the Mœris Lake, and constructed the Labyrinth. The Hyksos, or Shepherd Kings, invaded Lower Egypt ab. 2000 B.C. and took Memphis. They were overthrown by Aahmes I. of the seventeenth dynasty: one of his successors, Thothmes III., subjected all Syria and part of Mesopotamia, receiving immense tribute from Ethiopia, Assyria, Babylon, and the Isles, ab. 1444 B.C. Amenophis II. took Nineveh. Thothmes IV. probably erected the Sphinx. Rameses II., third monarch of the nineteenth dynasty, ab. 1322 B.C., defeated the Hittites, took Salem, subjected Ethiopia, and placed a fleet on the Mediterranean. He is supposed to be the Sesostris of legend; he and his son Menephtha appear to be the Pharaohs of the Exodus. Shashank I. (Shishak) of the twenty-second dynasty invaded Israel, and took Jerusalem between 9[illegible] and 959 B.C. Tirhaka (Tehrak), last of the twenty-fifth (Ethiopian) dynasty, aided Hezekiah of Judah against Sennacherib. Nechos II. of the twenty-sixth dynasty projected a canal across Isthmus of Suez, but, warned by an oracle, desisted, having lost 120,000 men in the attempt. He defeated Josiah, King of Judah, and was defeated by Nebuchadnezzar. Amasis conquered Cyprus; his son was overthrown 526 B.C. by Cambyses, who founded the twenty-seventh (Persian) dynasty. After 340 B.C. E. was subject to the Persians, till conquered by Alexander, after which it was under the Greek rule of the Ptolemies. P. Philadelphus founded the Alexandrine library, and caused the Septuagint translation and the History of Manetho to be made. The Greek period ended with Cleopatra and the Battle of Actium 30 B.C.; E. then be-

Egypt.

came a Roman province. It was temporarily conquered by Zenobia 270. Christianity was early introduced. Gnosticism arose, and later the Arian and Monophysite controversies. Christians were severely persecuted under Diocletian. Paganism was rooted out ab. 379. E. became one of the great patriarchates, but was conquered by Omar 640, and thenceforth ruled by successive dynasties of Arabs, and from 1254 by the Mamelukes. Damietta was twice taken by Crusaders 1219 and 1249. In 1517 E. became a Turkish province, governed by pashas. Bonaparte invaded it 1798, but the French were expelled by the Turks and British 1801. Mohammed Ali, 1806–1849, destroyed the Mamelukes, introduced many public improvements, and rendered part of Arabia, and afterward Syria, tributary for a time. Under Said Pasha, 1854–63, the Suez Canal was begun. The hereditary title of Khedive was granted 1866 to his nephew Ismail, who endeavored to introduce European civilization, and, with England, to suppress the Nile slave trade. The disordered condition of the finances occasioned the interference of European governments 1879. Ismail was succeeded by Tewfik Pasha 1879; demonstrations in favor of reform were made 1881, and constitutional government decreed Feb. 6, 1882. The rebellion of ARABI PASHA (q.v.) was crushed by an Anglo-Indian force under Wolseley at Tel-el-Kebir, Sept. 13, 1882. The Mahdi conquered Upper E. 1881–85. The joint control of England and France was abolished Jan. 18, 1883 Wolseley's second expedition was made 1884–85. Dervishes under Osman Digna were overthrown Feb. 1891. Abbas, son of Tewfik, became Khedive, Jan. 7, 1892. It is proposed to double the arable land by a dam at Assouan, which would increase the cotton producing district to such an extent that the Egyptian fellah could compete with American cotton. The total area of Egypt is ab. 400,000 sq. m., of which 12,976 are cultivated.

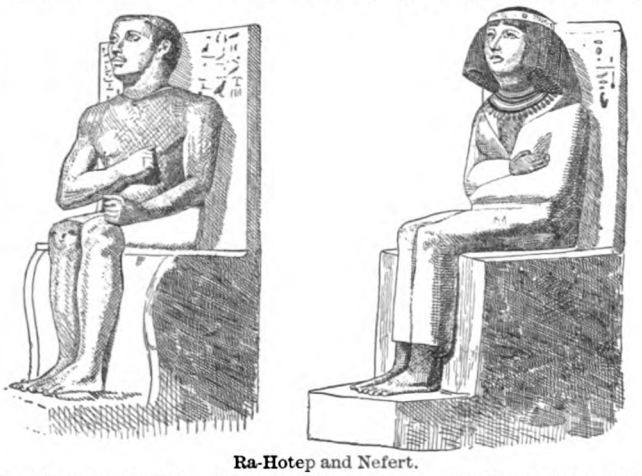
Egyptian Architecture. The earliest mode of building of which remains are still extant, and doubtless the first to deserve the name of an architectural style. It probably dates back to 3000 B.C., about which time the foundations were laid of the city of Memphis. The earliest structure, however, which still remains in a decipherable condition is the Great Pyramid, the hugest mass of masonry which has ever been erected, and of which Herodotus assigns the building to Cheops. The stones of which it was built were quarried in Arabia, and conveyed to the Nile by means of a road especially constructed for the purpose. The pyramid is 764 feet square at the base, and 480 feet in height, each face being an equilateral triangle with a slope of 51° 50′, and it is a solid mass, excepting small cells, the tomb at the center (17 ft. 1 in. by 34 ft. 3 in. and 19 ft. in height), and the passage to the same, which are protected from the pressure of the superincumbent mass by ingenious devices. Though the largest, this is but one of many pyramids still standing and intended for the same purpose, that of burial. Other early Egyptian monuments are also tombs, and are commonly excavated, although many are constructions, of which some are found almost complete and others in decipherable fragments or remains. One of the tombs at Gizeh is noteworthy as being supposed to have contained the earliest known example of an arch, of which the lowest voussoir (springer) alone remains. Another, at Beni



Temple of Amon, Karnac.

Hassan, exhibits the prototype of the Doric Order (see ARCHITECTURE). The walls of the tombs were often decorated with paintings, sometimes flat, at other times applied upon figures carved in low relief. The most elaborate and artistic works of Egyptian Architecture are the temples, to the earliest of which, at Thebes, is assigned the date of 2000 B.C., or a thousand years after the erection of the Great Pyramid. Of these the most noteworthy is the palace-temple at Karnac, of which the most impressive feature is the Hypostyle Hall, consisting of a nave and aisles, a clerestory admitting light. The nave, over 30 feet in width, is covered with single blocks of sandstone. This hall is 340 feet in length by 170 in width, and at the center over 70 feet in height, the columns which support the central ceiling being 62 feet in height, 11 feet 6 in. in diameter, and bearing capitals 22 feet in diameter. There are two rows of these columns, twelve in all, and 126 smaller columns, 43 feet in height, arranged in fourteen rows. The temple, of which this hall is the principal apartment, is by far the largest permanent building ever erected, measuring 1,200 feet in length by about 360 in width, and the date of about 1450 B.C. is assigned to it. Though this is the most extensive work of Egyptian architecture, there are other temples on the banks of the Nile displaying the same amplitude of resource on the part of the builders, the same massiveness of construction, and the same profusion of ornament, both carved and painted.

Egyptian Art (SCULPTURE AND PAINTING). The Egyptian style of sculpture, as known before the excavations of Mariette, was thought to be wholly conventional and formal. The statues, if standing, were represented with the left leg in advance, the arms hanging stiffly by the sides, and the head and shoulders turned square to the front. The seated statues were also posed stiffly, with hands resting on the knees. Ab. 1860 an earlier phase of it came to light, which exhibited greater scientific accuracy and occasionally a considerable amount of freedom and of lifelike quality in portraiture. The best known works of this class are *The Scribe*, in the Louvre; and, in Gizeh Museum, *The Wooden Man*, *The Kneeling Scribe*, *The Bread-Makers*, the statues of Ra-Hotep, of the lady Nefert, of



Ra-Hotep and Nefert.

Ra Neter and of Ti. These works belong to the Pyramid period, ab. 4000 B.C., and were buried in wells connected with the tombs. They represent the same superstition which led to the embalming of mummies. The spirit of the deceased was supposed to need the corporeal form, and to forestall the unhappy results of its possible destruction the statue was provided as a residence. Later Egyptian sculpture was especially devoted to portraits of the Pharaohs and high officials and to statues of the gods, all of the formal style. It was adept in the cutting of basalt and granite and in the production of works of enormous size, reaching on occasion a height of 75 feet or over, in the solid block. Egyptian painting is, like the sculpture, most lifelike in the earliest periods known to us. It is confined throughout, however, to certain formulas of profile representation, avoiding perspective and any appearance of recession or projection from the flat surface. The colors used are extremely brilliant and well harmonized. The paintings known are either those of the temple reliefs or the frescoes of tombs. The latter had, in the Pyramid period, the magical purpose of assisting the subsistence of the deceased in the next world. In the New Empire, after 1700 B.C., the tomb paintings are historical or decorative without magical purpose. In either case they offer a vast amount of information as to Egyptian domestic life, and are our main authority on this head.

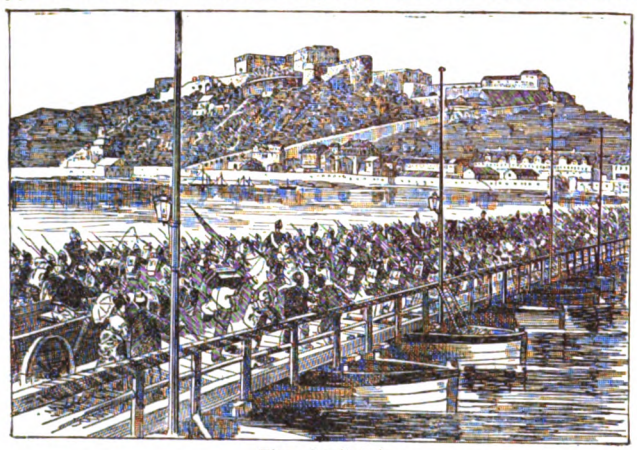
Egyptian Music. None of the papyri discovered thus far in Egypt has been found to treat of music, and nothing is known about Egyptian notation. These facts, and the circumstance that all allusions in classical books are general, compel investigators to rely upon speculation based upon paintings and sculptures for their knowledge of ancient Egyptian music. The art of the moderns is of course that of the Arabs. The ancient Egyptians possessed representatives of all the families into which musical instruments are ordinarily divided; *i.e.*, percussive, stringed, and wind. Those of the harp family were the most highly developed; mural paintings found in the burial vaults of Memphis and Thebes show harps with from 11 to 21 strings, a perfectly-developed sounding-board, and great beauty of form and ornamentation. All the stages of evolution from this down to the primitive bow, bent with three or four strings and having but a rudimentary sounding-board, are depicted.

A knowledge of the principles of acoustics is also indicated by the existence of instruments of the guitar kind with finger-boards. Of flutes there were several varieties, beak flutes, blown at the end, which may have been pipes with vibrating reeds, oblique flutes, played like the modern instruments, and double flutes, familiar from the paintings and sculptures of the Greeks and Romans. Of pulsatile or percussive instruments there were the sistram, which stood high, its invention being accredited to Isis, cymbals, clappers, tambourines, and various kinds of drums. Music was put to the same uses in religious, military, and social life that it is to-day among civilized peoples, and the extravagance which sometimes marked its culture is indicated by pictures showing bands of over 50 instrumentalists besides singers and dancers. At these performances the music seems to have been under the direction of a leader, who marked the time by clapping his hands.

Egyptology. See EGYPTIAN ART and HIEROGLYPHICS.

Ehrenberg, CHRISTIAN GOTTFRIED, 1795–1876. Prof. Berlin 1827; specialist in the study of atmospheric dust. *Sylva mycological Berolinenses*, 1818; *Ueber das Pollen der Asclepiadeen*, 1831; *Mikrogeologie*, 1854.

Ehrenbreitstein. Fortified town on right bank of Rhine, opposite Coblentz. The fortress, on an almost inaccessible rock,



Ehrenbreitstein.

387 ft. above the river, was begun 1672; taken by the French 1799, and destroyed 1801; awarded to Prussia by Congress of Vienna 1815, and restored 1816. Pop., 1890, 5.281.

Ehrhart, BALTHASAR, M.D., d. 1756. German botanist. *Œconomische Pflanzenhistorie*, 1753–62.

Ehrhart, FRIEDRICK, 1742–1795. Swiss botanist. *Natural History*, 1787–92.

Eichberg, JULIUS, 1824–1893. German-American composer of *The Doctor of Alcantara*, 1862; *The Cadis*, and other operas; founder and director Boston Conservatory of Music 1867.

Eichendorff, JOSEPH, BARON VON, 1788–1857. German poet, novelist, and dramatist. *Hist. German Poetry*, 1857.

Eichens, FREDERIC EDOUARD, 1804–1877. German engraver. His most noted works are *Titian's Daughter*, and *The Vision of Ezekiel*, after Raphael. His plates are much esteemed.

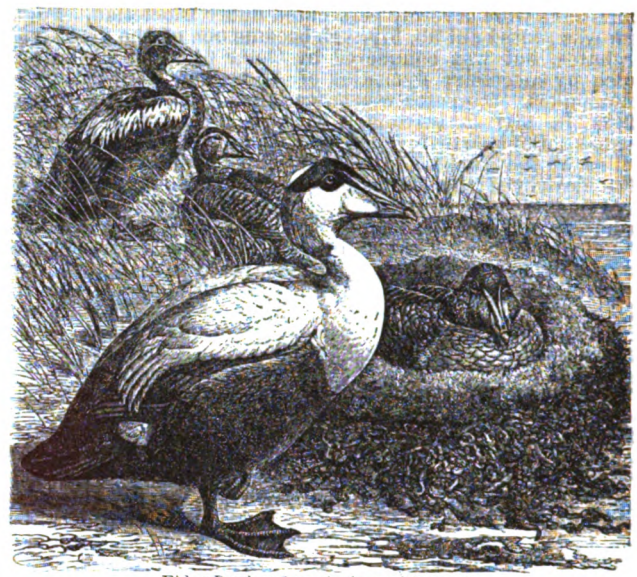
Eichens, PHILLIPPE HERMANN, 1812–1886. German engraver, famous for his line work and lithographic drawings. He received four medals at Paris. *La Montre*, after Toulmouche; *A Haymaker*, after Brochart, and *The Betrothal Ring*, after Weisz, are among his best plates.

Eichhoff, FRIEDRICH GUSTAV, 1799–1875. French orientalist and philologist; Prof. Lyons 1842. *Études sur Ninive, Persépolis et la mythologie de l'Édda*, 1855; *Grammaire générale indo-européenne*, 1867.

Eichhorn, JOHANN GOTTFRIED, D.D., 1752–1827. German rationalist, prof. at Jena 1775, and Göttingen 1788. He was the first to treat the Bible in a purely literary way, in his Introductions to O. T. 1780–83, Apocrypha 1795, and N. T. 1804–14. He also wrote histories of the world, 5 vols., 1799–1814, and of literature, 6 vols., 1805–13.—His son KARL FRIEDRICH, 1781–1854, prof. at Göttingen 1817–28, wrote 4 vols. of *German Political and Legal History*, 1808–23.

Eichwald, EDUARD, 1795–1876. Russian naturalist, prof. Kasan 1823, Wilna 1827, St. Petersburg 1838. *Travels to the Caspian Sea and Caucasus*, 1834–37; *Palæontology of Russia*, 1851.

Eider Ducks. Sea ducks of Arctic regions; resemble river ducks in having an unfenestrated tracheal labyrinth. The female is reddish-brown with dark bars, male is sable below and cream color above, in the spring, after the third year. Nest is among stones, in hollow of soil, and furnished with dry sea-weed. At most five eggs are laid, and the nest then is lined with down, 1¼ oz., plucked by female from her breast. 72,000 nests are annually robbed of their down in Greenland and Ice-

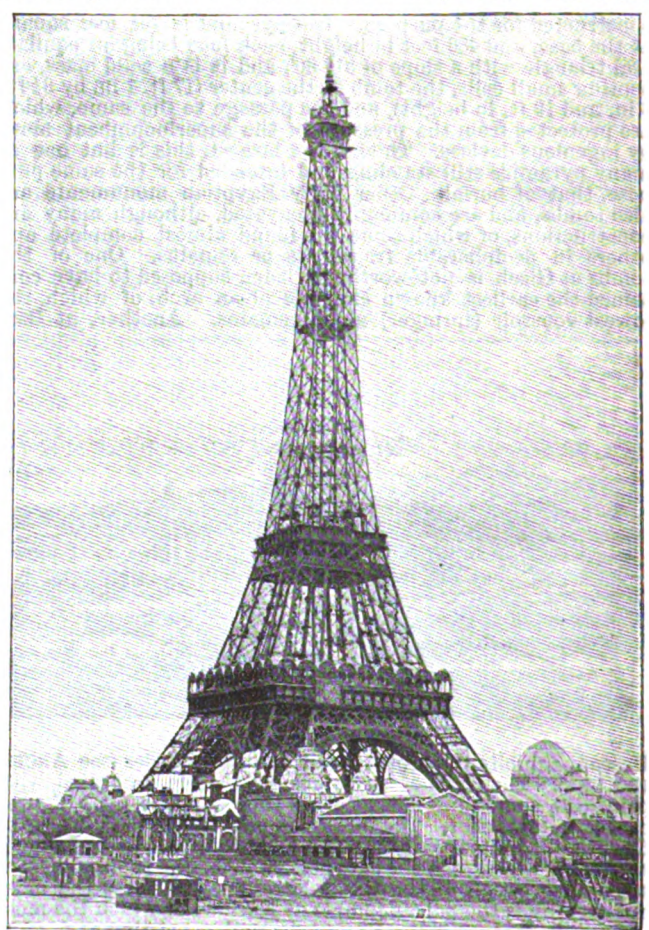


Eider-Ducks (*Somateria mollissima*).

land. In Norway, eiders are specially protected, the eggs and down are taken by specially authorized persons daily as laid, thus stimulating the bird to produce a large supply.

Eidlitz, LEOPOLD, b. 1823. American architect born in Prague, Bohemia, removed to New York 1843. He is the designer of the Brooklyn Academy of Music, St. George's Church in New York, and of much of the new capitol at Albany, N. Y. The temple Emanu-El, New York City, is also his work.

Eiffel Tower. Graceful, wrought-iron tower built for the Paris Exposition of 1889 by Gustave Eiffel (b. 1832). It is 984 ft.



Eiffel Tower.

high, the highest structure ever erected. Its wt. is 7,300 tons exclusive of the elevators and their machinery.

Eight Diagrams. Chinese magical emblem, consisting of broken and unbroken lines taken three at a time. The resulting eight combinations are usually arranged to form an octagonal figure in which four of the diagrams agree with the cardinal and four with the intermediary points. The combination is regarded as symbolic of the universe, and is employed as a charm to keep off evil spirits, as well as a counting circuit in ceremonial divination.

Eight Genii. The Chinese distinguish two principal kinds of genii, the celestial, who live in the skies, and the terrestrial, who dwell on earth and live in the solitude of the mountains. Of the latter, eight enjoy special consideration among the Saoists, and their images, pictures, and emblems are very common in China as ornaments and decorations. They figure largely in the historical romances, and appear to be more or less directly associated with the four directions and the intermediary points.

Eighty Years' War. Between Spain and the United Provinces 1567–1648. See HOLLAND.

Eikon Basilike. Work defending Charles I. of England, pub. 1649, soon after his execution, and purporting to have been written by him, but probably by Bp. John Gauden, 1605–1662.

Eikonogen. $C_{10}H_7SO_4$. Amidobetanaphthol sulphonic acid; prepared by the reduction of nitrosobetanaphthol sulphonic acid by hydrogen; soluble in alkali with the formation of a salt; white substance; a powerful reducing agent, used in photography.

Eiloart, MRS. ELIZABETH, b. 1830. English novelist and writer of juvenile tales.

Eilythyia. Ancient city of Egypt, originally called Nuben, with ruins of Ramesean and Ptolemaic temples. In the neighborhood also are rock tombs of the 18th, 19th, and 20th dynasties.

Ein'feste Burg. Luther's German paraphrase of Psalm XLVI., probably written 1530. Its melody, also by Luther, plays an important part in Protestant music.

Eisenach. German town in Saxe-Weimar amid beautiful scenery. It has large manufactures and a fine old palace and castle with associations with the Minnesingers and Luther. Pop., 1890, 21,399.

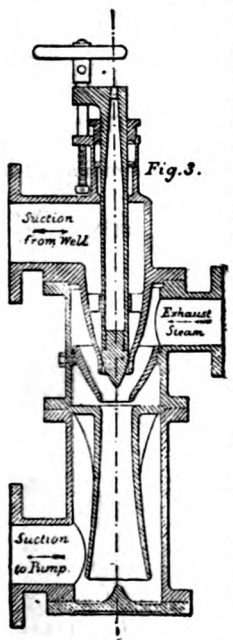
Eisenlor, OTTO, 1806–1853. Author of observations and studies in the climate of Karlsruhe, Baden.

Eisteddfod. Assemblage of Welsh bards, dating from ancient times, and held annually since 1819.

Ejaculatory Ducts. Formed by union of vasa deferentes and ducts of the seminal vesicles. They open into the urethra, into which they convey the semen.

Ejectment. Common law action to recover the possession of land and damages for wrongful detention. The defendant must be in possession, and plaintiff must recover on the strength of his own title, not on defects in defendant's. Its procedure has been modified generally by modern statutes.

Ejector. Instrument for displacing large volumes of fluid against low resistances by means of the velocity of a jet of steam. It differs from an injector in that the latter operates on relatively smaller volumes and against higher pressures. A jet of steam at high velocity induces a current of the fluid to be moved (Venturi's principle), and when the steam and the other fluid are mingled at the nozzle the latter is entrained by the velocity of the power. It is used to drain or lift water, and to create air-vacua.



Ejector.

Ekaterinburg. Russian fortified town, the center of the mining industry of the Ural Mts. It has a large Siberian trade. Pop., 1887, 33,739.

Ekaterinoslav. Fortified town in s. Russia, on the Dnieper. Pop. ab. 50,000.

Ekeberg, ANDERS GUSTAF, 1767–1813. Swedish chemist.

Ekebergite. $Ca(Na_2)Al_2Si_2O_8$. Variety of Wernerite.

Ekron. One of the five chief towns of Philistia on the boundary of Judah. It was the last place to which the ark was taken before its return to Israel. Its god was BEELZEBUB (q.v.).

Elaboration. In plant physiology, processes within the plant which convert inorganic into organic matter.

Elachisteæ. Family of dark green *Algæ*, mostly of marine distribution.

Elæagnaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising 3 genera and ab. 30 species, natives of the temperate regions of the n. hemisphere; commonly called the Oleaster family.

Elæoblast. Homologue of the notochord, which appears in the posterior end of the embryo of *Salpa*.

Elagabalus, or HELIOGABALUS (VARIUS AVITUS BASSIANUS), 204–222. Roman emperor 218; reigning as Marcus Aurelius Antoninus; pretended son of Caracalla; priest of the sun at Emesa; a dissolute and worthless boy.

Elaic Acid. See OLEIC ACID.

Elaidic Acid. $C_{18}H_{34}O_2$. Mpt. 45° C. White crystalline acid, produced from oleic acid by the action of nitrous anhydride; of the same composition as the oleic acid from which it is formed.

Elaidin. White solid, melting at 32° C.; obtained by the action of nitrous acid upon olive oil; glyceride of elaidic acid.

Elain. See OLEIN.

Elam. Biblical name of Susiana, district n.w. of Persian Gulf.

Eland. Largest of antelopes, 6 ft. high, 9 ft. long. It resembles the ox in build but has nearly straight horns almost 3 ft. long, those of the bull have a spiral ridge. The color is

Eland (*Buselaphus oreas*).

fawn to yellow. It is easily hunted, and in danger of extermination, but also easily domesticated, valuable for food, and noted for its great amount of fat. Its native habitat is S. Africa.

Elapidæ. Family of *Proteroglypha*, including poisonous snakes with cylindrical body, fusiform tail, and lateral nostrils. The poison fangs have an internal canal and an anterior groove. They are tropical, the majority inhabiting India and Australia: *e.g.*, the COBRA (q.v.); the *Naja*, or Asp of Egypt; the *Ophiophagus*, or Snake-Eater of India, which grows to a length of 15 ft. and is the most venomous of reptiles, its bite proving fatal in three minutes. *Elaps* includes the Coral Snake, the Harlequin Snake (*E. fulvus*), so gentle as to be thought harmless by the uninformed, and the *Hopalocephalus* of Australia, exceedingly poisonous.

Elapina. See PROTEROGLYPHA.

Elasipoda. Group of deep-sea Holothurians, having slug-like bodies, a single madreporite, no respiratory tree, much modified ambulacral ampullæ, and on the back long horn-like tentacles. There are short leaf-like oral tentacles, and the skin has wheel-like spicules.

Elasmobranchii. See SELACHII.

Elasmosaurus. Marine saurian, resembling Plesiosaurus, but with a longer neck; found in American cretaceous strata, sometimes 45 ft. long. The head and neck were swan-like in proportion, the feet were paddles; the tail acted as a rudder; the animal fed on fish, which it was enabled to seize by long sharp teeth in its jaws.

Elasticity. That property of matter in virtue of which a body requires force to change its bulk or shape, and requires a continued application of the force to maintain the change. "The elasticity is said to be perfect when the body always requires the same force to keep it at rest in the same bulk and shape and at the same temperature through whatever variation of bulk, shape, and temperature it be brought." "The degree of distortion within which elasticity of shape is found is essentially limited in every solid." It is said then to be elastic within certain limits, called the "limits of elasticity." Liquids are almost if not quite perfectly elastic; gases are perfectly elastic.

Elasticity of Demand. Greater or less tendency of a person or of the market generally to demand more of a commodity if its price falls, or less if its price rises.

Elasticity of the Air. Property by which the air resists compression or expansion, giving rise to the so-called Boyle-Mariotte Law. See BOYLE, LAW OF.

Elastic Limit. The unit-stress within which a body recovers its original form after removal of the stress, and above which a permanent set remains; or, that unit-stress below which the elongations or compressions are proportional to the applied stresses. The mean values of the elastic limits of materials are: for timber 3,000, for cast-iron 4,000, for wrought-iron 25,000, and for steel 40,000 lbs. per sq. inch. See ELASTICITY.

Elateridæ (SPRING-BEETLES). *Coleoptera* with five-jointed tarsus, elongated body, a free articulation between the prothorax and the mesothorax, and a projection on the former

Elateridæ.
1. Corymbites pectinicornis. 2. Elater sanguineus. 3. Corymbites signatus.

which fits into a cavity of the latter and enables them to right themselves with a snap-like jump when lying on their backs. The larvæ often live on the roots of cultivated plants and are destructive.

Elaterium. Sediment from juice of the Squirting Cucumber (*Ecballium elaterium*); powerful cathartic, due to Elaterin.

Elaters. Hygroscopic filaments attached to the spores of horsetail-rushes, liverworts, etc., coiled up when moist, but expanded when dry, and very sensitive in this respect. They thus assist in spore dissemination.

Elatinaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising two genera and ab. 20 species, distributed throughout all parts of the earth; commonly called the Water-Pepper family.

Elba. Island between Corsica and Tuscany, where Napoleon was exiled May 1814–Feb. 1815. Area 87 sq. m., pop. ab. 24,000.

Elbe. River heading in n. part of Austro-Hungary, and flowing generally n.w. across Germany to the North Sea: navigable for 470 miles. Length ab. 720 m.; drainage area 59,000 sq. m.

Elberfeld. Manufacturing town of Prussia, on the Wupper, 16 miles e. of Dusseldorf. Pop. 1890, 125,830.

Elbing. Town of n. e. Prussia, near the Baltic; founded by the Teutonic Order ab. 1200. It has large manufactures. Pop., 1890, 41,578.

Elbow-joint Press. Form of press for various uses, in which the pressure upon the platen is produced by the action of jointed links in the form of the joint at the elbow or knee. When a force at right angles to the direction of the compression acts upon such a joint to straighten it, the relation of the power to the resistance is given by the formula $\frac{R}{P} = \frac{B}{2} \cot a$, in which B is the length of the variable line joining the fixed hinge at one end of one link with the moving-pin at the corresponding end of the other, and a is the angle which the links in any position make with that line. As this angle grows less, its cotangent becomes greater, and at 180° becomes infinite.

Elburz, Mt. Highest peak of the Caucasus, between the Black and Caspian Seas, on the boundary between Europe and Asia. Altitude 18,526 feet.—Also a range of n. Persia, s. and s. e. of the Caspian. Length ab. 450 miles; greatest height 21,000 feet.

Elchingen. Village of Bavaria, near Ulm. Here the French under Ney defeated the Austrians Oct. 14, 1805.

Eldad ben Malchi, or HA-DANI, 9th century. Jewish traveler in Asia and Africa; author of a work pub. 1518, and tr. into Latin and German.

El Dakkel. Fertile Libyan oasis ab. 200 m. w. of the Nile, an ancient wheat district.

Elder. 1. Shrubs of the genus *Sambucus* of the natural family *Caprifoliaceæ*, mostly natives of the n. hemisphere.

Flowering Branch of Common European Elder (*Sambucus nigra*): *a*, flower; *b*, berries.

The flowers of *S. canadensis* are sudorific, the fruit laxative, and the inner bark cathartic and emetic. 2. Name erroneously applied to *Aralia hispida*, a N. American bristly herb of the Ginseng family.

Elder. Ancient Hebrew office. In N. T., presbyter.

Elder, MARSH. See HIGHWATER SHRUB.

Elder, PRESIDING. In M. E. Ch., head of a district, whose business it is to hold quarterly meetings throughout it. At the annual conference, the presiding elders form the bishop's council.

Eldon, JOHN SCOTT, EARL OF, 1751–1838. M.P. 1783; Solicitor-gen. 1788; Atty.-gen. 1793; Chief-justice of C. P. 1799; Lord Chancellor 1801–6 and 1807–27; Earl 1821.

El Dorado. Mythical country long believed to exist in the n. part of S. America, for three centuries a strong allurement for adventurous spirits.

Eleanor OF GUIENNE, ab. 1122–1203. Wife of Louis VII. 1137; divorced 1152 and married to Henry II. of England, bringing him her vast estates; mother of Richard I.; imprisoned for instigating rebellion.

Eleatic School. Founded ab. 530 B.C. at Elea, s. Italy, by Xenophanes. He and his pupils, PARMENIDES and ZENO (q.v.), were pure idealists and metaphysicians.

Eleazar. Son of Aaron, and his successor as High-Priest of Israel.

Elecampane. *Inula helenium.* Officinal perennial herb of the Composite family, native of Europe, introduced into N. America.

Elecampane (*Inula helenium*). *a*, flower.

Election. Doctrine that every soul that attains to eternal life is chosen out of mankind by God's eternal purpose.

Election. 1. Right to choose, or choice between alternative rights, causes of action or remedies: when once deliberately exercised, no other alternative can be pursued. 2. Choice of officers by those possessing the elective franchise; generally regulated minutely by constitutions and statutes.

Electoral Commission, PRESIDENTIAL. Authorized by Congress Jan. 23, 1877; elected Jan. 31. It consisted of 5 Senators, 5 Representatives, and 5 Associate

Justices of the Supreme Court, and was charged with the determination of questions arising from the discordant certificates of the electoral colleges of S. C., La., Ore., and Fla. It organized Feb. 1, and reported March 1, by a strict party vote of 8 to 7, in favor of R. B. Hayes.

Electoral Crown or **Cap.** Emblem of dominion worn by the Electors of the old German Empire. It was a scarlet cap turned up with ermine with a gold arch above enriched with pearls, surmounted by a gold orb and cross.

Electors. German princes, who had the right to choose the Emperor. They were seven 1256–1648, then eight, and nine 1692–1777. The office became obsolete upon the dissolution of the Empire 1806.

Electors, PRESIDENTIAL. Chosen directly or indirectly by the people of the several States to elect the President and Vice-President. They are now named by party conventions, and vote for the party candidate. They equal the number of representatives to which each State is entitled in both Houses of Congress; in 1892 there were 444. They meet to cast their votes at the several State capitals on the first Wednesday of the Dec. following the general election, and these votes are counted by Congress on the 2d Wed. of Feb. ensuing.

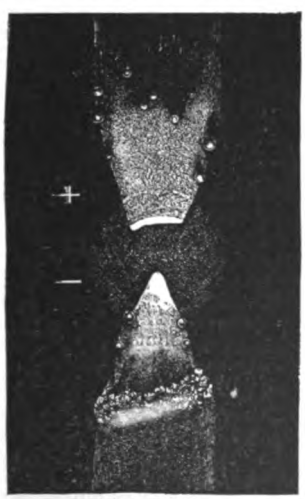
Electra. Daughter of Agamemnon and Clytemnestra; sister of Orestes, whose life she saved when her mother murdered her father, and whom she incited to avenge his death.

Electric. It was formerly supposed that some bodies could be electrified when rubbed with fur or silk, while others could not. Referring to this property, all bodies were divided into two classes, electrics and non-electrics. Dr. Gilbert called them "ideoelectrics" and "anelectrics." In the light of our present knowledge, however, no such distinction can be made; all bodies are electrics.

Electrical Images. Conception of Lord Kelvin's. If an electrified point P is outside any conductor connected with the earth (and therefore at 0 potential) there will be induced on the conductor a certain charge of opposite electricity, the effect of which at all points outside the conductor is the same as that of an imaginary electrified point P′ inside the conductor, while its effect at all points inside is equal and opposite to that of P. P′ is called the electrical image of the point P. If M′ is the locus of all the images of the points which compose any electrified body M, M′ is the electrical image of the electrified body M.

Electrical Osmose. It was observed by Parret that if strong currents are led into certain liquids having a porous partition between the electrodes, a part of the liquid is carried through the partition, increasing the level on one side. This electric osmose is more manifest in badly conducting liquids. The transfer is in the some direction as that of the current.

Electric Arc. Phenomenon produced when a current of electricity of high electromotive force is made to pass across the air space between two slightly separated conductors, as the two carbons in an arc lamp; sometimes called the Voltaic Arc. See ELECTRIC LIGHT.



Electric Arc.

Electric Battery. See BATTERY, ELECTRIC.

Electric Cautery. In some surgical operations a fine platinum wire, heated red hot by a current of electricity, is used instead of a knife. Platinum is chosen on account of its infusibility, though even in this case the current must not be too strong. In the throat and nose the electric cautery has been found especially useful.

Electric Chimes. Apparatus consisting of three small bells suspended from a horizontal conducting rod in connection with the prime conductor of an electric machine. The middle one is hung by a silk thread and connected with the ground by a chain. Between the bells are small copper balls, hung by silk threads. When the machine is in action the two outside bells, which are positively electrified, successively attract and repel the balls, which in turn are successively repelled and attracted by the middle bell, which has a negative charge by induction. The impacts produce a tinkling sound, which continues as long as the machine is in action.

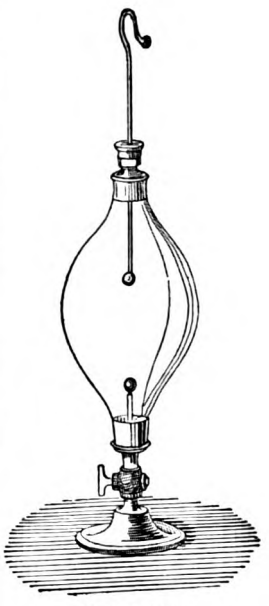
Electric Density. Amount of electricity on a unit of surface of any electrified body. If the body be a spherical conductor, the density is constant over the surface; if an ellipsoid it is greatest at the ends of the longest axis.

Electric Distillation OF LIQUIDS. Phenomenon closely connected with that of electric osmose. It was noticed by Beccaria that an electrified liquid evaporated much more rapidly than one not electrified. Gerney has lately shown that in a bent glass tube containing two portions of liquid, one of which is electrified largely positive and the other negative, the positive portion gradually passes over to the negative. Only good conductors present this phenomenon noticeably.

Electric Drill. One in which the motive power is furnished by an electric motor geared to the drill, so as to form a light and efficient tool. Feed screws of different pitch are furnished for varying the speed of boring and a friction clutch protects the motor, should any hard material be struck suddenly. In bituminous coal the drill shows a speed of from 5 to 7 ft. per minute. In "boney" coal, about 3 ft. per minute, and in anthracite ab. 6 ft. per minute. The drill complete weighs from 100 to 160 pounds, and thus meets the requirements of strength, lightness, capacity, ease of action, adjustability, practicability, and economy.

Electric Eel. See APODES.

Electric Egg. Ovoid glass vessel, partially exhausted of air, and furnished at its ends with conductors by which an electric discharge may be made to pass through the rarefied gas.


Electric Egg.

Spark in Rarefied Air.

Electric Elasticity. In a conductor electrical displacement takes place without opposition. But in an insulator acting as a dielectric, electric displacement calls into action an internal electromotive force acting in a direction opposite to that of the displacement. This Maxwell by analogy has called the electric elasticity of the medium. The ratio of the electromotive force to the displacement produced by it is called the coefficient of electric elasticity.

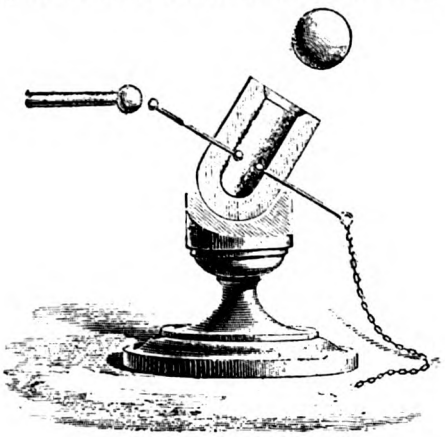
Electric Fly. See ELECTRIC WHIRL.

Electricity. Unknown agent to which is supposed to be due a large class of physical phenomena. As far as is known, its properties are not such as to justify its classification under the head of either matter or energy. Electrical phenomena may be due to various conditions of the luminiferous ether, and the evidence that the ether plays a prominent part in such phenomena would seem to be strengthened by the fact that the ratio of the actual values of the units in the two systems employed, viz., the C.G.S. electromagnetic and the C.G.S. electrostatic systems, is the velocity of light. Electricity is apparently as indestructible as matter or energy. Many persons are disposed to consider it identical with the luminiferous ether. The electric phenomena of attraction and repulsion were first observed in amber by the Greeks, and were mentioned by Thales of Miletus 600 B.C. and by Theophrastus in his treatise on Gems. Little advance was made in the

subject till 1600, when Dr. Gilbert discovered that many other substances besides amber possess the same properties. That electrification is of two kinds was observed first by Du Fay 1733. The great names in connection with our progress in knowledge as to the real nature of electricity are Franklin, Cavendish, Faraday, and Maxwell, not to mention many living philosophers and experimenters who have done most to extend and apply this mysterious agent to modern uses. Applications of electricity have made their way into almost every department of human life, and this may be called the age of electricity.

Electric Light. See ARC LAMP and INCANDESCENT LAMP.

Electric Mortar. If a hole in a block of wood be covered lightly with a cork and an electric spark be made to pass



Electric Mortar.

between two wires within the cavity the sudden expansion of the air will lift the cork from the opening. A quantity of gunpowder discharged in the same way may throw the cork to some distance.

Electric Oscillator. Apparatus devised by Hertz for starting electromagnetic waves in the ether. It consisted of two metallic conductors (balls or plates) united by a metal rod, at the middle of which was interposed a spark-gap between two well-polished knobs. These conductors were connected each to a terminal of the secondary of an induction coil. The waves were received and detected by another piece of apparatus called the ELECTRIC RESONATOR (q.v.).

Electric Pendulum. Small pith ball covered with gold leaf and freely suspended by a silk thread. It serves as an electroscope to indicate the presence and kind of electrification on a charged body.

Electric Portrait. A sheet of gold leaf is pressed between two sheets of card, in one of which outline slits, representing some portrait, have been cut through. If a sheet of paper be put upon the back of this one and a strong electric discharge be sent through the gold leaf, the latter will be vaporized, the vapor passing through the openings to the paper and there leaving a tracing of the picture which was cut in the card.

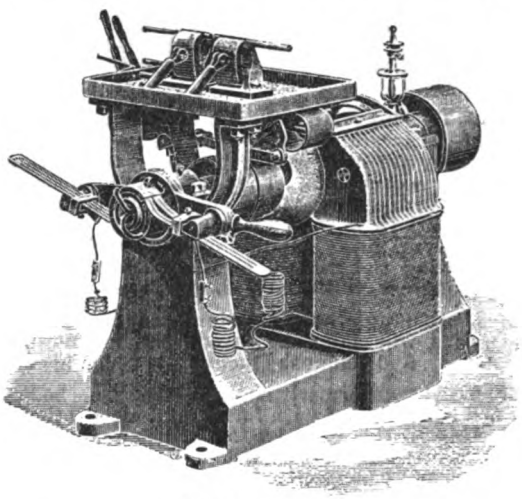
Electric Railways. The electric railway was first proposed 1835, and a model built by Thomas Davenport. The first practical application of electricity to propulsion was in 1879 in Cleveland, O. In the four following years it was tried in San Francisco, Allegheny, Pa., Saratoga, N. Y., and Chicago. The trolley system, whereby the current from a wire operates a motor under the car, is the one in most common use. The average cost of electric railways is ab. $11,000 per mile for track, $10,000 per mile for stations, shops and wires, and $4,000 per mile for rolling stock. The average operating expenses are ab. 12 cents per car per mile.

Electric Ray. See RAYS.

Electric Resonator. Apparatus devised by Hertz to receive and detect the electromagnetic waves in the ether produced by an electric oscillator. It consists simply of a ring or square of wire open at one place; this opening, called the spark-gap, is minutely adjustable.

Electric Tension. If two conducting disks in contact in an electrical field be so situated that their faces are perpendicular to the direction of the electromotive force, and if they then be separated, they will be found to be oppositely electrified. Therefore, when in contact, they tend to separate from each other and to approach the oppositely-elecrified surfaces bounding the field. This force, thus acting within the dielectric mass, is electric tension. It is proportional at each point to the square of the electromotive force at that point. This condition of stress in the dielectric medium Faraday fully recognized.

Electric Welding. When two wires or rods of metal are pushed together end to end and at the same time a very strong electric current is passed through them, the heat developed at the junction softens the metal, and the pieces may be made to



Electric Welding.

cohere. The processes of electric welding have been perfected by Elihu Thomson. Alternate current-transformers, capable of producing currents of many hundred amperes at a pressure of only a few volts, are employed.

Electric Whirl. Rectangular wire cross, with the arms pointed and turned at right angles so as all to point in the same direction. The whole is capable of turning on a pivot at its center. If this be charged from the conductor of an electrical machine, the electrification escaping rapidly from the points will cause the wheel to revolve in the opposite direction.

Electric Wind. Current of air produced by the discharge of electricity from a pointed conductor.

Electrification. Process of producing in any body a so-called electric charge. The electrification developed on glass when it is placed in contact with silk has been arbitrarily called "vitreous" or positive; and that appearing on sealing-wax after it has been in contact with flannel is called resinous or negative. All electrification is one or the other of these two kinds. Any two heterogeneous substances when brought in contact with each other are oppositely electrified, and the one which is positively electrified is said to be electropositive to the other, which is electronegative. Thus electric substances may be arranged in a series such that each is electropositive to those that follow it, but electronegative to all that precede it.

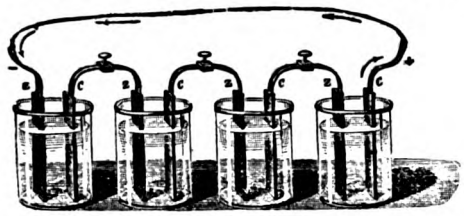
Electrocapillarity. Phenomenon observed in two conducting fluids in contact; *e.g.*, if water and mercury be brought in contact, the surface of separation has three properties; surface tension, a difference of potential on the two sides of it (the water and mercury being two heterogeneous bodies in contact), and electrostatic capacity, as the surfaces are really separated by ab. $\frac{1}{20000000}$ of a centimeter. These properties are found to depend upon one another, so that if any one be varied the others will change also. Lippman has utilized this action in the construction of a capillary electrometer and an electrocapillary engine.

Electrochemical Equivalent. Quantity of an element expressed in units of mass which is set free by the passage of a unit quantity of electricity through an electrolyte in which the element occurs as an ion. Thus $m = \gamma c t$; in which m is the quantity of the element set free in time t by a current whose strength is c, and γ is the electrochemical equivalent.

Electrocution. Execution by electric shock, a form of capital punishment adopted by the State of New York 1888. The victim is strapped in a chair and the current applied at the head and calf of the leg.

Electrode. Originally, conductor by which an electric current enters or leaves an electrolyte; now, any conductor by which electricity enters or leaves an electrical apparatus of any sort. That at which the current enters the electrolyte is

called the Anode; that by which it leaves it, the Kathode. The components of the electrolyte are called Ions: the ion which



Battery of Four Elements.

appears at the anode is the Anion; that at the kathode is the Kathion.

Electrodynamics. Branch of electrical science which treats of the mechanical actions of electrical masses upon one another. It is divided into electrostatics, treating of the phenomena of attraction and repulsion of electricity at rest; and electrokinetics, treating of the phenomena of attraction and repulsion of electricity in motion, *i.e.*, those which take place during adjustment of electrical potential by the passage of a current in a conductor. In some text-books electrodynamics is made to include the mutual action of currents only.

Electrodynamometer. Instrument employed to measure the strength of an electric current. The current is passed through a coil which is suspended in a powerful magnetic field maintained either by an electromagnet or by a fixed coil of wire through which a current is made to pass. If the current to be measured pass through both coils, it can be shown that the rotating couple acting on the suspended coil is proportional to C^2, and therefore proportional to the energy of the current.

Electrokinetics. Division of electrodynamics, treating of electricity in motion.

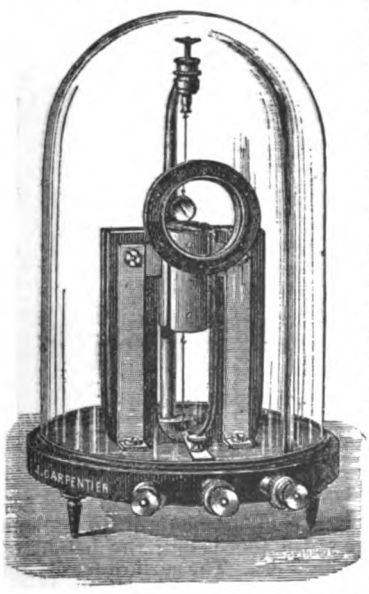
Electrolysis. In a certain class of liquids, as acids, alkalies, and salts, either fused or dissolved in water, transference of electricity takes place, not by simple conduction as in solid metals, but solely by atomic convection. This process of transference is called electrolysis or electrolytic conduction, and the substances in solution whose constituent atoms or atomic groups act to carry the electric charges are called electrolytes.

Electrolytic Conduction. Process of transference of electricity through a certain class of liquids; usually called ELECTROLYSIS (q.v.).

Electromagnet. If a coil of insulated wire through which an electric current is passed be placed about a soft iron core, the core becomes a temporary magnet and the combination is called an electromagnet.

Electrometallurgy. Art of precipitating metals from the solutions of their salts by an electric current. The metal is deposited on the negative pole, while the acid becomes free at the positive. The process was discovered by Spencer in England, and independently by Jacobi in St. Petersburg in 1839. The art is sometimes called Galvanoplastics.

Electrometer. Instrument for directly measuring the difference of electrical potential between two points. The quadrant electrometer of Sir W. Thomson consists of a hollow metal cylindrical box divided into four quadrants, separated from one another by a small space. Each pair formed by two opposite quadrants are joined together by a wire, but insulated from the other and adjacent pair. Within the box and suspended by a silk fiber, which passes out through a hole in the middle between the quadrants, is a figure of eight-shaped aluminium needle, which is insulated from the rest of the apparatus and capable of receiving an electric charge. Each pair of quadrants is connected with one of the electrified points, and the attraction and repulsion exerted on the needle are measured by the angle of torsion in the suspending fiber. This angle is usually measured by the deflection of a spot of light reflected from a small mirror attached to the suspension.



Carpenteir's Quadrant Electrometer.

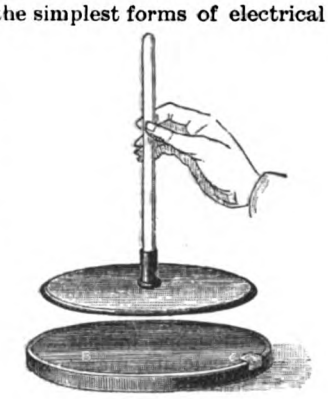
Electromotive Force. Result of a difference of electric potential, or that difference of condition between two points by which an electric current is caused to flow from one point to the other. Difference of potential is analogous to difference of level or head of water in hydraulics. Electromotive force is not force in itself, and the name does not even specify the force which determines the flow. The term electromotive difference of potential has been suggested instead. The practical unit is the volt.

Electromotive Series. Arrangement of metals with reference to their electrical deportment when employed as the elements of a galvanic battery. The most electropositive metals are placed at one end of the series, the most electronegative at the other. Each metal in the series is electropositive to all those that come after it, and electronegative to those that precede it. A few of the more common metals may be arranged in an electromotive series, as follows:

1. Zinc,	5. Iron,	9. Copper,
2. Cadmium,	6. Nickel,	10. Silver,
3. Tin,	7. Bismuth,	11. Gold,
4. Lead,	8. Antimony,	12. Platinum.

Electronegative. When any two dissimilar substances are placed in mutual contact, they are oppositely electrified. The one negatively electrified is said to be electronegative to the other. See ELECTRIFICATION.

Electrophorus. One of the simplest forms of electrical machine. It was contrived by Volta, and consists of a metallic pan or mold, called the form, filled with resin. There is also a circular metallic plate, called the cover, and furnished with an insulating handle. If the resin be electrified by beating it with cat's fur, and the cover be placed upon it, the latter will have induced upon its under surface a bound charge of positive electricity, and if the negative charge on the upper surface be allowed to escape to the ground, the plate when removed will possess a free positive charge. The operation may be repeated as often as desired without any apparent loss of charge on the electric.



Electrophorus.

Electropositive. See ELECTRIFICATION and ELECTRONEGATIVE.

Electropuncture. Introduction into the tissues of needles through which is passed an electric current.

Electroscope. Instrument employed for detecting the presence of electrification. Bennett's consists of a pair of gold leaves suspended within a glass jar from a conducting rod terminating outside the jar in a ball, usually of brass. It is used also to indicate the kind of electrification present.

Electrostatics. Division of electrodynamics which treats of electricity at rest.

Electrotonic State. Condition or change in the electromotive properties of a living nerve when stimulated by an electric current.

Electrotonus. Condition of a living nerve, as defined by its electromotive properties, when a part of the nerve is interposed in a galvanic circuit. Parts of a nerve in its natural state are electropositive to the other parts, and the alterations in the natural condition produced by the stimulating current is called the "electrotonic state." Pflüger has called the part of the nerve comprised in the exciting circuit the Intropolar Region; the condition of the nerve close to the positive pole is called Anelectrotonus, and that near the negative pole Kathelectrotonus.

Electrotype. Facsimile of a medal or engraved plate, obtained by means of the electrolytic deposition of copper or silver upon a mold rendered a conductor by means of graphite. The first successful experiments were made 1839 by Jacobi at St. Petersburg. Among the commonest applications of the art are the production of copies of woodcuts and of printed pages set in type. These copies are much more durable than the originals and many electrotypes may be taken from them without injury. Each electrotype is capable of producing about 100,000 impressions.

Electrozemia. Capital punishment by electricity.

Electuary. Medicinal preparation, having as its base honey, syrup or any sweet substance, for internal administration.

Elegy. With the early Greeks, poem in distichs, *i.e.*, stanzas of two dactylic lines, hexameter and pentameter; afterward more widely applied. In modern literature, poem of subdued and reflective character, usually lamenting or celebrating the dead; *e.g.*, Milton's *Lycidas*, Gray's *Elegy*, and Shelley's *Adonaïs*.

Element. Ultimate and unanalyzable datum of anything whatever, mental or material, hence the fundamental constituents of any compound.—In chemistry, a substance whose atoms or smallest particles are all of the same kind.—In the calculus, the differential of a specific function of a locus; *e.g.*, the differential of the surface bounded by a curve is an element of surface.

Elemental Spirits. According to mediæval superstition, spirits dwelling in and ruling the four elements, Earth, Air, Fire, and Water, being respectively Gnomes, Sylphs, Salamanders and Undines.

Elementary Algebra. This considers quantity as represented by letters and operations, indicated by signs. It treats of the fundamental operations of addition, subtraction, multiplication, division, involution, evolution, classifies quantity as known or unknown, and discusses the methods of determining the unknown from known conditions, through equations, proportions and series.

Elementary Desires. Those which operate merely as tendencies to action, not developed by the exercise of thought into tendencies toward abstractions. Such are the desires of safety and security, of possessions, of family and civil society, of superiority, and of knowledge.

Elementary Forces. Heat, Gravity, Muscular Force, Electricity, from one or more of which all motive power for industrial purposes is derived.

Elementary Machines. The few simple organs upon which the elementary forces act to produce motion and to do industrial work. These are the Lever, Inclined Plane, Jointed Link, and Hydraulic Press.

Element IN DETERMINANTS. Each of the n^2 quantities, the arrangement of which forms the determinant.

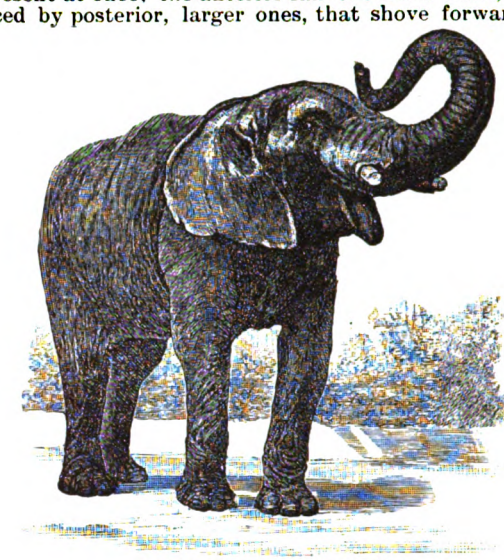
Elements, CHEMICAL, IN THE SUN AND STARS. In the Sun the spectroscope indicates the presence of hydrogen, iron, titanium, calcium, manganese, nickel, cobalt, chromium, barium, sodium, magnesium, platinum, and perhaps copper, palladium, vanadium, molybdenum, uranium, aluminium, cadmium, carbon, lead, helium, and possibly oxygen. The following have been recognized in Stars: sodium, magnesium, calcium, iron, bismuth, hydrogen, and indications of a number of others. In Comets, hydrogen, carbon, sodium, magnesium, and possibly iron.

Elements OF A PLANET'S ORBIT. Six quantities are necessary for fixing the path of a planet in space; viz. 1. The inclination of the plane of the orbit to the ecliptic. 2. The angle which the line of intersection with the ecliptic makes with the line of the equinoxes, called the longitude of the node. These two quantities fix the position of the plane of the orbit. 3. The major axis of the ellipse. 4. The eccentricity. These determine the form and dimensions of the orbit. 5. The position of the major axis in the plane, called the longitude of the perihelion. 6. The position of the planet at some given epoch. The symbols employed for these quantities in astronomical works are as follows:

α = the mean distance.
e = the eccentricity.
θ or Ω = the longitude of the node.
i or ϕ = the inclination.
Ω or π = the longitude of the perihelion.
ε = the mean longitude at a given epoch.

Elements OF STRUCTURE. Successive positions of the generating line or surface.

Elephant. (See PROBOSCIDEA.) Including the Mammoth, Mastodon and Dinotherium, there are ab. 30 species, but only two or three are now living. The African species is the tallest, reaching 11 ft.; it has large ears, convex forehead, lozenge-shaped areas on the molars, and four toes visible on the pad of the manus and three on the pes. These afford the whitest ivory. They were domesticated by the Carthaginians and Egyptians, but are now all wild. The Indian elephant, distinguished by flat forehead and four toes visible in hind feet, has feebler tusks, rarely present in the female, and is domesticated to a great extent and used for work. Those kept captive do not breed; though in America, since 1880, several young have been born in menageries. The first baby elephant born in America was 34 in. high, weighed 213 lbs., and had a trunk a foot long. The father weighed 4 tons, and was 26 years old. Elephants can live far beyond 100 years. The tusks are upper incisors, without enamel, but growing persistently, and may attain a weight of 200 lbs. Only one, or, at most, two molars are present at once; the anterior fall out when worn, and are replaced by posterior, larger ones, that shove forward. The



African Elephant ("Jumbo").

sixth and last is over a foot long. The first is functional from 3d month to 2d year; the third from 2d year to 9th, and the fourth from 6th to 20th year. The tusks are preceded for the first two years by milk-teeth. The elephant begins breeding at the 15th year and is full-grown at 30 years. The proboscis contains 40,000 muscles. The food consists of boughs, roots,

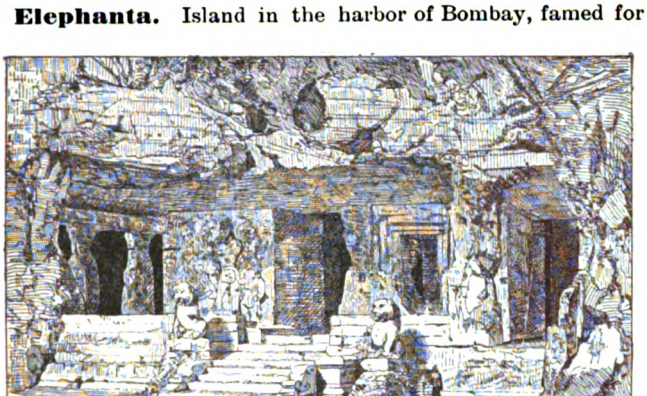
Indian Elephant

etc. The stomach has a water compartment of 10 gallons capacity. The circumference of the foot is half the height of the body. The brain weighs ab. 10 lbs. The earliest fossils are in the Miocene of India. American fossil elephants are Pleistocene. The fossil pigmy elephant of Malta is less than 4 feet

high. Dinotherium, the most gigantic of fossil elephants, had lower tusks only. White elephants are albinos. The elephants of Ceylon and Sumatra have tusks rarely and confined to the male; they are gentle. It has been estimated that 100.000 tusks bearing elephants are slain each year to supply the world with ivory. There is great danger of these slow-breeding giants becoming extinct. The period of gestation is 21 months.

Elephant, ORDER OF THE. Highest order of chivalry in Denmark, instituted by Christian I. 1462. Its statutes were renewed 1808.

Elephanta. Island in the harbor of Bombay, famed for



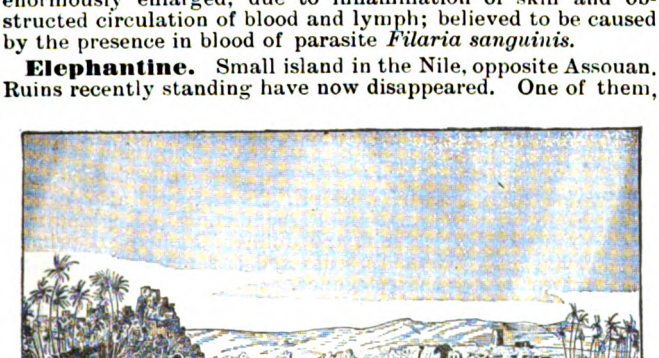
The Lions' Cave at Elephanta.

its rock-cut Brahman temples, of which four are in good preservation. They are not earlier than the 9th century.

Elephant Apple. *Feronia elephantum.* Large tree of the Orange family, native of India, bearing a large pulpy fruit with a woody rind.

Elephantiasis. Chronic disease, occurring oftenest in tropical sea coasts, in which legs or genital organs become enormously enlarged, due to inflammation of skin and obstructed circulation of blood and lymph; believed to be caused by the presence in blood of parasite *Filaria sanguinis.*

Elephantine. Small island in the Nile, opposite Assouan. Ruins recently standing have now disappeared. One of them,



Elephantine.

a small temple anticipating the Greek peripteral form, was figured in the *Description de l'Egypte.*

Elephant's Foot. Species of the genus *Elephantopus,* plants of the Composite family, natives of N. and S. America.

Eleusinia. Annual festival celebrated during nine days at Athens and Eleusis. The great mysteries were performed and candidates initiated. The lesser Eleusinia were held at Agræ on the Ilyssus. Little is known regarding these secret rites.

Eleusis. Town of Attica, 12 m. n.w. of Athens, famous for its temple of Demeter (Ceres), and for the mysteries celebrated here annually in her honor. The temple was razed by Alaric; its ruins are insignificant.

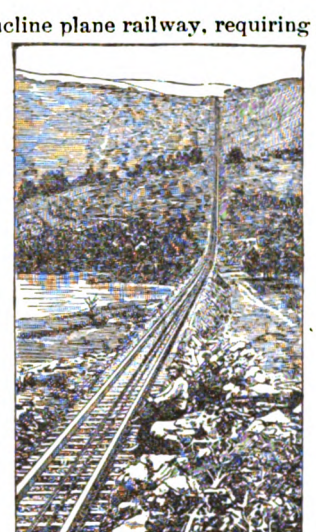
Eleutheria. Greek festival held annually at Platæa from 479 B.C. to celebrate the defeat of the Persians. The Samians had a festival of the same name in honor of Eros.

Eleutheroblasteæ (HYDRIDA, GYMNOCHROA). Order of *Hydroida,* including the fresh-water *Hydra;* characterized as *Hydromedusæ* having no medusa-buds, but developing ova and spermatozoa in the body-wall of the polyp. The nutritive buds are set free; hence the name.

Eleutheropetalous. See POLYPETALOUS.

Elevated Railway. Track raised on columns above the surface of the ground. In 1821 one was proposed by Palmer, a British engineer, and in 1825 a short one was built at Cheshunt. Those of New York, completed 1883, cost $22,700,000. The trains on these are drawn by small locomotives, as also in Brooklyn. Electric propulsion has been used in a few other localities to a limited extent.

Elevating Railway. Incline plane railway, requiring a cable or other special means to draw up the cars. The Otis railway in the Catskills, one of the longest systems in the U. S., is illustrated in the figure.



Otis Elevating Ry., Catskill Mts., N.Y.

Elevation. In Architecture, a geometrical drawing of the front, side or rear of a building.

Elevation of the Host. That part of the Mass where the priest raises and shows to the people the consecrated bread and wine. It was introduced into the Roman Church in the 11th century as a protest against the heresy of Bérénger, who denied the real presence.

Elevation of Outer Rail. The outer rail on a railroad curve is elevated above the inner in order to counteract the centrifugal force due to the speed. The greater the speed and the sharper the curve, the higher is the elevation; as a maximum this is about 12 inches.

Elevator. Machine by which a platform or cage is lifted from one level to another in a building. The simplest forms are large dumb-waiters, operated by hand. Power elevators are driven by belting from a shaft, open and crossed belts being shifted from loose to fast pulleys to drive a worm and wheel to wind or unwind the rope; larger sizes have their own independent reversible steam or gas hoisting-engines, or are hydraulic elevators. In the latter, water is pumped to a tank at the roof of the building, and its head gives the power to drive a piston which actuates the hoisting-rope. The head of water acting from the height may drive a multiple purchase with short piston stroke. Where the elevator is not to be in constant motion the hydraulic principle has great advantages, and works more smoothly and often more rapidly than the other designs in any case.—The term elevator is also applied to the establishment where grain is stored and by whose machinery the grain in bulk is loaded and unloaded from vessels or cars. Systems of buckets on endless belts lift the grain out of the hold or car, endless belt conveyors distribute it into elevated bins, from which chutes deliver it, when graded, by gravity into the shipping vessel. In flour mills the elevator is a similar system of buckets on an endless belt, by which material is lifted from floor to floor.

Elf. In Norse mythology a spirit of the air answering to the Greek sylph. Mediæval folklore recognized two classes of both sexes, one beautiful and benevolent, the other ugly and wicked. They were only visible to children who had been born on Sunday. They were minute beings of great strength and usually wore glass shoes and belled caps.

Elgin. City of Kane co., Ill., on Fox River, 36 m. w. n.w. of Chicago; noted for its manufacture of watches. Pop., 1890, 17,823.

Elgin, THOMAS BRUCE, SEVENTH EARL OF, 1766–1841. British Minister at Constantinople 1799–1803. He spent some £74,000 on ruining the Parthenon and exporting its remains.—His son, JAMES BRUCE, Eighth Earl, 1811–1863, was Gov. of Jamaica 1842–46, Gov.-gen. of Canada 1847–54, and of India 1861. He negotiated treaties with China and Japan 1859.—His son, VICTOR ALEXANDER BRUCE, Ninth Earl, b. 1849, became Viceroy of India 1893.

Elgin Marbles. Greek sculptures, mainly from the Parthenon, brought from Athens to England 1803 by Lord Elgin; bought by the nation 1816 for £35,000 and deposited in the BRITISH MUSEUM (q.v.). The removal of these matchless works of art from the most famous temple of Greece, though done by

permission of the Turkish government, was a disgraceful act of vandalism.

Part of the Frieze of the Parthenon.

Elgueta. In n. Spain; scene of defeat of republicans by Carlists, Aug. 5-6, 1873.

Eli. High-priest of Israel in the childhood of Samuel, who announced to him the ruin of his house for not having restrained the vileness of his sons.

Elia, ESSAYS OF. See LAMB, CHARLES.

Elias Levita, 1472–1548. German Jewish rabbi, settled at Venice; author of a commentary on the Hebrew Scriptures, a grammar, and a lexicon.

Elie de Beaumont, JEAN BAPTISTE ARMAND LOUIS LEONCE, 1798–1874. French geologist; prof. Paris School of Mines.

Elijah. Greatest of the early prophets of Israel. He maintained the worship of Jehovah against that of Baal and Astarte, especially as patronized by Jezebel; and was translated ab. 896 B.C.

Elim. Station in the Sinaitic wilderness, where the Israelites, soon after leaving Egypt, found 12 fountains and 70 palm trees.

Eliminant, or RESULTANT. In a system of equations, determinant (formed from homogeneous equations) which must equal zero in order that the original equations be simultaneous.

Elimination. Process of obtaining from a given group of equations new groups, less in number and involving fewer unknowns or variables; ultimate is a single equation involving but one unknown.

Eliot, CHARLES WILLIAM, LL.D., b. 1834. Prof. of Chemistry in Harvard 1858–63, and Mass. Inst. of Technology 1865–69; Pres. Harvard from 1869. Under his leadership the oldest and largest American university has adopted an elective order of studies, and has made great progress in usefulness, and in adaptation to the wants of the time in higher education.

Eliot, GEORGE. Pen name of MARIAN EVANS 1819–1880.

George Eliot.

English novelist of highest rank; tr. Strauss' *Life of Jesus*, 1846, and Feuerbach's *Essence of Christianity*, 1853. Her genius ripened slowly, and was fostered by her connection with G. H. Lewes, 1854–78. *Scenes of Clerical Life*, 1857; *Adam Bede*, 1858; *Mill on the Floss*, 1859; *Silas Marner*, 1861; *Romola*, 1863; *Felix Holt, the Radical*, 1866; *Middlemarch*, 1871–72; *Daniel Deronda*, 1877; *Impressions of Theophrastus Such*, 1879. In verse she wrote *The Spanish Gypsy*, 1868; *Agatha*, 1869; *Jubal*, 1870, and *Armgart*, 1871; these were far less successful than her novels. In 1880 she became Mrs. J. W. Cross. Her works are marked by deep earnestness, skeptical sadness, profound knowledge of human nature, and sympathy with human life.

Eliot, SIR JOHN, 1592–1632. English patriot; leader in the impeachment of Buckingham 1626, and in the Commons' resistance to the arbitrary measures of Charles I.; imprisoned from March 4, 1629. His writings were pub. 1879-82.

Eliot, JOHN, 1604–1690. Pastor at Roxbury, Mass., from 1632; missionary to the Indians from 1646, and translator of the Bible into their tongue 1663.

Elis. District of Greece on w. coast of Peloponnesus; important chiefly because of the temple and worship of Zeus at Olympia, and the games held there every 4 years in his honor.

Elisæus, d. 480. Armenian bishop. His *History of Vartan* was pub. 1764, and tr. 1830; his other works were collected 1838.

Elisha, d. ab. 840 B. C. Disciple and successor of Elijah; honored in Israel through a long prophetic career.

Elishah. O. T. name of Greece. Ezek. xxvii. 7.

Elixir Vitæ. Preservative against death, and also to transmute base metals into gold, long sought by alchemists.

Elizabeth. City of Union co., N. J., on Newark Bay, 13 m. s.w. of New York. Pop., 1890, 37,764.

Elizabeth, 1533–1603. Queen of England 1558; daughter of Henry VIII. and Anne Boleyn. She committed England to Protestantism and antagonism to Spain; her reign was disturbed by Catholic intrigues which were terminated by the execution of Mary Stuart 1587, and the defeat of the Spanish Armada 1588. She was a wise and vigorous sovereign at a critical period; her reign is the most memorable in English history, and was adorned by Shakespeare, Bacon, Spenser, and a host of famous men.

Elizabeth, MME., 1764–1794. Sister of Louis XVI. of France.

Elizabeth OF BOHEMIA, 1596–1662. Daughter of James I. of England; m. 1613 to the Elector Palatine, who was king of Bohemia 1619–20, and thenceforth in exile; mother of Princes Rupert and Maurice, who fought for Charles I., and grandmother of George I. of England.

Elizabeth, ST., OF HUNGARY, 1207–1231. Daughter of King Andreas II., wife of Landgrave Ludwig of Thuringia 1221–27; eminent for beneficence and ascetic piety; canonized 1235.

Elizabethan Architecture. Sometimes also called Tudor; style which followed the Perpendicular in England under the influence of Holbein and John of Padua. It principally survives in noblemen's seats and is remarkable for size and heaviness rather than elegance.

Elizabethan Nuns. Romish monastic recluses of the Franciscan Order instituted 1395. They took their name from St. Elizabeth of Hungary.

Elizabeth Petrovna, 1709–1762. Empress of Russia from 1741; daughter of Peter the Great and Catharine I. She opposed Frederick II. in the Seven Years' War, and founded Univ. of Moscow.

Elk. The American Elk or Wapiti, *Cervus canadensis*, is distinguished from the smaller Red Deer by its broader hoofs, shorter tail, and redder color, darkest in neck and legs and becoming dusky on throat and belly; the rump is yellowish white. This is the summer pelage. Once distributed over the whole of North America, it is now restricted to Oregon and vicinity. Full grown antlers are 52 in. long, weigh 40 lbs., and resemble those of red deer. The deer known as Elk in Europe is called MOOSE (q.v.) in America. See also IRISH ELK.

Wapiti (*Cervus canadensis*).

Elkanah. Ephraimite, father of the prophet Samuel.

Elkhart. City of Elkhart co., n. Indiana, on St. Joseph River. Pop., 1890, 11,360.

Elkins, STEPHEN BENTON, b. 1841. M.C. 1873–77; Sec. of War, 1891–93.

Elk Mountains. Group in w. Colorado. They are composed in part of volcanic rocks, in part of stratified beds, are very rugged and have many peaks exceeding 13,000 ft. The highest is Castle Peak, 14,115 ft.

Ell. Linear measure originally denoting the distance from the elbow to finger tips. It was used in measuring cloth, an English ell being 45 in.

Ellagic Acid. $C_{14}H_6O_8$. Bezoardic acid. Occurs as a constituent of certain animal concretions, especially in Oriental bezoars, and in bark of the Oak and Fir, and in sprouts of Divi-Divi. Prepared from bezoars and from gallic acid or tannin by treatment with iodine. Pale yellow, light, tasteless powder of microscopic prisms, insoluble in water or ether.

Ellenbrough, EDWARD LAW, LORD, 1750–1818. Atty.-gen. 1801; Baron and Lord Chief-justice of King's Bench 1802.—His son, EDWARD LAW, 1790–1871, was Gov.-gen. of India 1841–44, and became an Earl 1844.

Ellerton, JOHN, b. 1826. English hymnist.

Ellery, WILLIAM, 1727–1820. Signer of the Declaration of Independence; collector at Newport, R. I., from 1790.

Ellet, CHARLES, 1810–1862. Civil engineer; builder of the suspension bridge over the Schuylkill at Fairmount 1842, and of one at Niagara 1847.

Ellicott, ANDREW, 1754–1820. U. S. Surveyor-gen. 1792; prof. math. at West Point 1812.

Ellicott, CHARLES JOHN, D.D., b. 1819. Prof. Univ. Cambridge 1860; Bp. of Gloucester and Bristol 1863; author of commentaries, chiefly on the Epistles, and of a *Life of Our Lord*, 1860.

Elliot, JEAN, 1727–1805. Scottish lyric poet, author of *The Flowers of the Forest.*

Elliotson, JOHN, 1791–1868. Physician; prof. Univ. London 1831–38.

Elliott, CHARLOTTE, 1789–1871. English hymnist, author of *Just as I am*, 1836.

Elliott, EBENEZER. 1781–1849. English poet and iron-founder. *Corn Law Rhymes*, 1825.

Elliott, STEPHEN, 1771–1830. Pres. Bank of S. C. from 1812; prof. in Charleston 1825. *Botany of S. C. and Ga.*, 1821–24.—His son, STEPHEN, D.D., 1806–1866, was Bp. of Ga. from 1840. Of his children, STEPHEN, 1832–66, was Brig.-gen. C.S.A.; ROBERT WOODWARD BARNWELL, D.D., 1840–1887, became Bp. of Western Texas 1874; SARAH BARNWELL pub. novels. *Jerry*, 1891, and *John Paget*, 1893.

Ellipse. Conic, formed by a plane cutting a right circular cone, making with its axis an angle greater than that made by an element. It is the locus of a point so moving that the sum of its distances from two fixed points (foci) is constant.

Ellipsis. In Grammar and Rhetoric, a form of expression by which something implied is omitted. In Printing, dashes, dots, or stars, to mark omissions.

Ellipsoid. Solid generated by the movement of a variable ellipse parallel to a fixed plane, having its vertices always in two ellipses having a common axis in planes at right angles to each other and to the fixed plane.

Elliptical Functions. Integrels in the forms

$$\int \frac{d\,\theta}{r\,(1-c^2\,\sin^2\,\theta)} : \int r\,(1-c^2.\,\sin^2\,\theta)\,d\,\theta :$$

$$\int \cdot \frac{d\,\theta}{(1+a\,\sin^2\,\theta)\;r\;(1-c^2\,\sin^2\,\theta)}.$$

They are so called because the second of the group, when $c =$ the eccentricity of an ellipse, expresses the length of an arc of the ellipse measured from the extremity of the minor axis. The integrals all have zero as the inferior limit: θ, the variable superior limit, is called the amplitude of the function. When the amplitude $(\theta) = \frac{\pi}{2}$, the functions are called complete. $c < 1$ and is called the modulus: a, which appears only in the last of the group, is the parameter.

Elliptic Arch. Arch whose intrados has the curve of a semi-ellipse; used when more waterway is required than a segmental circular arch would furnish.

Elliptic Coördinates. Elements used to investigate curves on an ellipsoid, or to determine points in space in reference to a fundamental conicoid.

Ellipticity of the Earth. Ratio of the amount of flattening at the poles to the semi-equatorial axis; the value now generally adopted is $\frac{1}{299}$. That the earth is flattened at the poles was first shown by Sir Isaac Newton.

Elliptic Paraboloid. Solid generated by the movement of a variable parabola having its vertex in a parabola traced in a fixed plane perpendicular to the plane of the moving parabola whose axis is parallel always to that of the fixed parabola and concavity in the same direction. If the concavities are in different directions, there will be formed the Hyperbolic Paraboloid.

Elliptic Wheel. Toothed wheel whose pitch-line is an ellipse, and whose axis passes through one focus; generally used in pairs, to produce a quick return motion of a reciprocating tool, as in a shaper or clotter. When the short radius of the driver drives the long radius of the follower, the tool moves slowly for the cut, and with great power; when the long radius of the driver acts on the short radius of the follower, the return is made rapidly. There are two points of equal motion between the extremes.

Ellis, ALEXANDER JOHN, F.R.S., b. 1814. English writer on phonetics. *On Early English Pronunciation*, 1869–89.

Ellis, GEORGE, 1745–1815. Ed. *Specimens of Early English Poets*, 1790, and *Romances in Meter*, 1805.

Ellis, GEORGE EDWARD, D.D., LL.D., b. 1814. Pastor at Charlestown, Mass., 1840–69; pres. Mass. Hist. Soc. *Half-Century of Unitarian Controversy*, 1857; *Puritan Age and Rule*, 1888.

Ellis, SIR HENRY, 1777–1869. Antiquarian; chief librarian British Museum 1827–56; knighted 1833; ed. Brand's *Antiquities*, 1813. *Elgin Marbles*, 1847.

Ellis, JOB BICKNELL, b. 1829. Botanist. *N. American Fungi*, 1878–93.

Ellis, ROBINSON, LL.D., b. 1834. Prof. Univ. Coll., London, 1870–76; ed. and tr. Catullus.

Ellis, WILLIAM, 1794–1872. English missionary to South Sea Isls. 1816–24; sec. London Miss. Soc. 1832–41. *Hawaii*, 1826; *Polynesian Researches*, 1829; *Madagascar*, 1858, '67, '70.

Elliston, ROBERT WILLIAM, 1774–1831. Eng. actor, eminent in both comedy and tragedy; manager of Drury Lane 1819–26.

Ellora. Hindoo village near Aurungabad, famed for cave-temples and others hewn from the rock inside and outside.

Caves of Ellora, Bombay.

There are 34 of large size, some Buddhist, some Brahmin, and some of the Jain sect, dating not earlier than the 7th century.

Ellsworth, OLIVER, LL.D., 1745–1807. Judge of Conn. Superior Court 1784; U. S. Senator 1789–95; U. S. Chief-justice 1796–1800.—His son, WILLIAM WOLCOTT, LL.D., 1791–1868, was law prof. Trinity Coll. from 1827, M. C. 1829–34, Gov. of Conn. 1839–42; Judge Conn. Superior Court 1847–61.

Ellwood, THOMAS, 1639–1713. English Quaker; friend of Milton, to whom he suggested the topic of *Paradise Regained;* author of sundry works in prose and verse. *Autobiography*, 1714.

Elm. Trees of the genus *Ulmus*, natural family *Ulmaceæ*, natives of the n. hemisphere.

Elm, BASTARD. See HACKBERRY.

Elmira. City of Chemung co., N.Y., on Chemung River, a branch of the Susquehanna; settled 1790; chartered as a city 1865. It has extensive manufactures. Pop., 1890, 30,893.

Elm-leaf Beetle. *Galeruca xanthomelæna.* The adult is oblong, $\frac{1}{4}$ in. long, yellowish, with a black line on each wing-cover. In May, when leaves have developed on the elm, this insect leaves its hibernating place and feeds on the leaves. In a few days the yellow, bottle-shaped eggs are laid in a double row under the side of the leaf. Throughout June the different

batches of eggs hatch into small, blackish larvæ, that develop some yellow on the back as they grow. They eat the cells from the under side, while the adult eats clean through; hence the leaves dry up, turn brown, and soon fall. The larvæ descends the tree-trunk after 20 days. At the base of the tree they

Elm-leaf Beetle.

a, eggs; *b*, larvæ; *c*, adult; *e*, eggs, enlarged; *f*, sculpture of eggs; *g*, larvæ, enlarged; *h*, sideview of enlarged segment of larvæ; *i*, dorsal view of same; *j*, pupa, enlarged, *k*, beetle, enlarged; *l*, portion of elytron, enlarged.

change into soft, yellowish pupæ, that become adult in 8 or 10 days. In dry weather the adults feed a month, then prepare for hibernation. If tree makes new shoots, a new brood may be produced. Spray at first appearance, and repeat often, with water 150 gals., Paris green 1 lb., lime 1 lb., glucose 3 qts.

Elm-Wood. Tough timber, little used in carpentry; its ultimate compressive strength is about 7,000 lbs. per sq. inch.

Elocution. Power or faculty of using fluent speech.

Elongation of the Moon OR A PLANET. Angular distance between the body and the sun.

Elongation under Tension. The elongation of a bar of length l under a stress S per square unit of cross-section is $\frac{Sl}{E}$, in which E is the coefficient of elasticity of the material. This formula is true only when the stress S is less than the elastic limit of the material.

El Paso. Capital of El Paso co., Texas, on the Rio Grande, opposite the terminus of the Mexican R. R. Pop., 1890, 10,338.

Elphinstone, MOUNTSTUART, 1779–1859. Scottish historian, Gov. of Bombay 1819–27. *Cabul*, 1815; *India*, 1841.

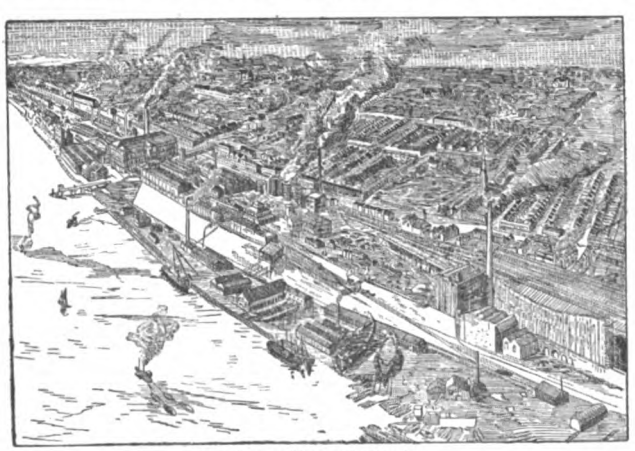
Elphinstone, WILLIAM, 1431–1514. Bp. of Ross 1481, and Aberdeen 1483; Chancellor of Scotland 1484; keeper of the Privy Seal from 1500; chief founder Univ. of Aberdeen.

Elsinore. Seaport of Denmark, on n.e. coast of I. Zealand; birthplace of Saxo Grammaticus; scene of *Hamlet;* held by Swedes 1658–60. Sound dues were collected till 1857. Pop., 1890, 11,082.

Elson, LOUIS CHARLES, b. 1848 in Boston. Musical critic and historian.

Elssler, FANNY, 1810–1884. Austrian dancer, well known in the U. S. 1841–42.—Her sister, THERESE, 1808–1878, long associated with her, m. Prince Adalbur of Prussia 1851.

Elswick. Suburb of Newcastle-on-Tyne, England. Here are situated the Armstrong engineering and ordnance works,



Bird's-eye View of Elswick.

which cover 125 acres, with a mile of river-front, and employ ab. 14,000 hands.

Elswick Cup. Obturating device, used at first with the Armstrong breech-loading guns as a gas check. It was a steel disk, cup-shaped in front, flat in rear, and held against the face of the breech-screw by a central bolt, through which the vent passed. When the gun was fired the powder-gas forced the cup against a copper ring let into the gun, and this connection formed a gas-tight joint. It has been superseded by the De Bange pad, which consists of a cushion or pad of asbestos soaked in mutton-fat, pressed into shape and sewn up in canvas; a block of steel called the mushroom head, from its shape, is in immediate contact with the powder charge. When the gun is fired, the pressure crushes the pad between the head and the breech-screw, expands it in diameter, and thus forms a perfect gas-tight joint.

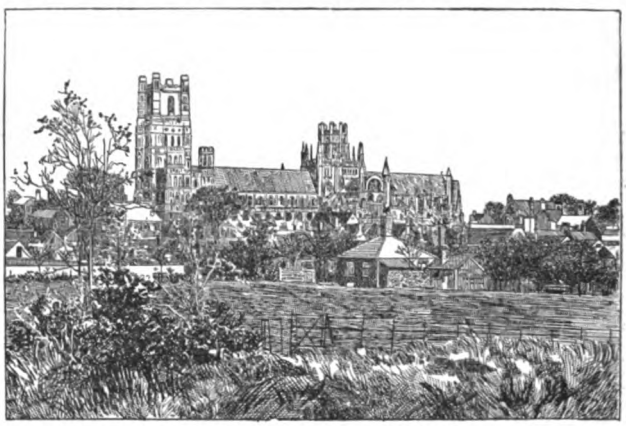
Elton, SIR CHARLES ABRAHAM, 1778–1853. Tr. Hesiod, 1809. *Classic Poets*, 1814.—His grandson, CHARLES ISAAC, b. 1839, M.P. 1884, has pub. law-books and *Origins of English History*, 1882.

Elutriation. Separation of the lighter from the heavier particles of a powder by washing and decantation. Employed in concentrating ores, in the preparation of pigments, and in the manufacture of materials used in pottery.

Elvan. Cornish, crystalline rock, resembling quartz porphyry; occurring in veins in the neighborhood of granite.

Elwell, FRANK EDWIN, b. 1858. American sculptor.

Ely. City of England, on the Ouse, 16 m. n.n.e. of Cam-



Ely, from the Banks of the Ouse.

bridge; noted for its fine cathedral, begun 1083. Pop., 1891, 8,017.

Ely, RICHARD THEODORE. Ph.D., b. 1854. Prof. Johns Hopkins Univ. 1885–92, and Univ. Wis. from 1892. *French and German Socialism*, 1883; *Labor Movement in America*, 1886; *Taxation*, 1888; *Problems of To-Day*, 1888; *Political Economy*, 1889; *Social Aspects of Christianity*, 1889.

Elyot, SIR THOMAS. ab. 1490–1546. English author. *The Governor*, 1531; *Bibliotheca*, a Latin lexicon, 1538.

Elysée, THE PALACE OF THE. Official residence of the President of the French Republic. It stands at the corner of the Rue du Faubourg St. Honoré and the Avenue de Marigny, Paris. It was built by Molet 1718.

Elysium, or THE ELYSIAN FIELDS. In Homer, a happy land in the extreme West, where falls neither snow nor rain and cold is unknown. The Roman poets make it the residence in the lower world of the shades of the blessed.

Elytra. Hard anterior pair of wings or wing covers of beetles; also dorsal leaf-like folds on the back of certain Annelides (*Aphrodite*).

Elze, FRIEDRICH KARL, 1821–1889. Prof. at Halle 1876; ed. of *Hamlet*, 1857; biographer of Scott, Byron, and Shakespeare, 1854–70–76. *Elizabethan Dramatists*, 3 vols., 1880–86.

Elzevir, LOUIS, ab. 1540–ab. 1617. Dutch printer, founder of a house at Leyden which issued famous editions of the classics and other books, pub. 1592–1681.

Elzheimer, ADAM, 1578–1620. German painter.

Emanation. Doctrine taken by Neoplatonists and Gnostics from Asia and Egypt, that all finite things, instead of being created, are derived from or an efflux of Deity.

Emancipation. Release from another's authority. A child is emancipated at legal majority, or by voluntary relinquishment of parental control; the latter may be by express agreement or by implication, as by expulsion from home or abandonment, or by consent to the child's marriage.

Emancipation Proclamation. Issued by Pres. Lin-

coln Sept. 22, 1862, to take effect Jan. 1, 1863, for freeing the slaves in U. S. A supplementary proclamation was then issued, defining its application.

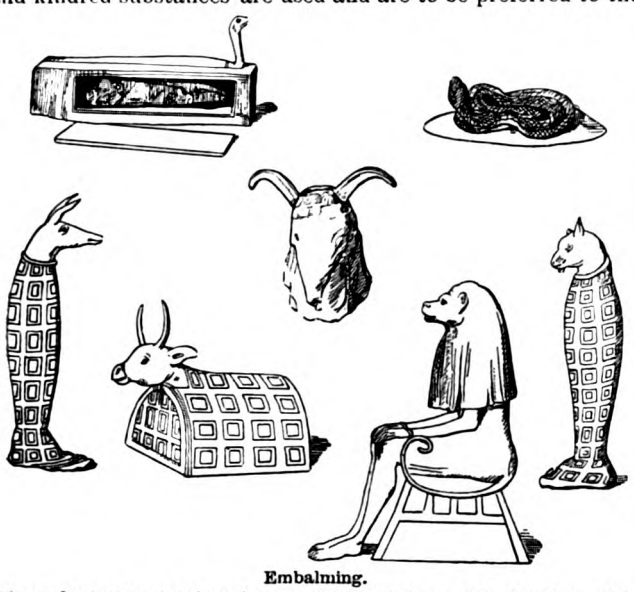
Emanuel I., 1469–1521. King of Portugal from 1495. He raised his country to its greatest height, but imitated Spain in persecuting the Jews.

Emanuel ben-Salomon, 13th century. Hebrew poet, resident mostly at Rome.

Emballonuria. Tribe of *Microcheiroptera*, including two families of Bats, *Emballonuridæ* and *Phyllostomidæ*.

Emballonuridæ. See BATS.

Embalming. Injection into the vessels and cavities of the dead body of substances to prevent decomposition. Arsenic, zinc chloride, or corrosive sublimate are the mineral salts most commonly employed; among organic bodies thymol and kindred substances are used and are to be preferred to the



Embalming.

mineral agents, as they in no way interfere with the detection of poison. By the Egyptians it was performed by disemboweling and impregnating the tissues with sodium chloride and sulphate, saltpeter, and some unknown resins, the body afterward being wrapped in coarse cloth.

Embankment. The slope of an embankment is measured by the ratio of horizontal to vertical projection; thus a slope of 1½ to 1 has a ratio of 1½ horizontal to 1 vertical. The slope usually is the same as the angle of repose of the earth. Earth placed in an embankment shrinks so as to occupy from 8 to 15 per cent less space than in the cut from which it was taken.

Embargo. Governmental prohibition of vessels leaving port: Civil, when directed against domestic ships; Hostile, when against foreign ships. That of 1807, forbidding commerce between the U. S. and foreign nations, was enacted to compel a change of attitude on the part of Great Britain, but worked great hardship to the people of the U. S. and occasioned much discontent on the part of the commercial element. See NON-INTERCOURSE LAW.

Embassy. Mission from one Court to another headed by an ambassador; the name is also given to the residence of an ambassador in a foreign city which enjoys certain privileges.

Ember Days. Wednesday, Friday, and Saturday, in weeks following (1) first Sunday in Lent, (2) Whitsunday, (3) Sept. 14, and (4) Dec. 13; ordained as fasts 1095, observed in R. C., Anglican, and P. E. Churches.

Embezzlement. Statutory offense of fraudulently converting property belonging to his principal and received by the accused in the fiduciary relation arising from his employment; created because of the narrow limits of common law larceny.

Embla. In Scandinavian mythology, the first woman, created with her husband Ask out of two trees by Odin, Hænir, and Lodur. Odin gave them the breath of life; Hænir, sense and motion; and Lodur, blood and a fair color, sight, speech, and hearing.

Emblem. Figure or picture representing one thing to the mind and another to the understanding, usually used to convey some moral truth. Books of emblems were very popular in the 16th and 17th centuries.

Emblements. Growing crops produced annually by industry. They belong to the personal representative of the tenant for an uncertain period, such as a tenant for life, whose term ends by the act of God or of the law.

Embole, or EMBOLIC GASTRULATION. That mode of the formation of the gastrula in which one side of the blastula pushes in or invaginates to make the archenteron. It obtains with alecithal ova and those containing little yolk.

Embolism. Obstruction of a blood vessel, more commonly of an artery, by a plug of material, which may be a blood-clot, fat, bacteria, or any foreign body, conveyed from some remote point.

Embolite. Ag(Cl,Br.). Valuable silver ore found in Chili; the silver is in combination with bromine and chlorine.

Embossing. Art of producing raised figures or designs on a plain surface by means of pressure or blows. The materials used for this kind of ornamentation are metal, wood, paper,

Basin of raised silver, executed for the Medici. Attributed to Benvenuto Cellini, but probably by Gaspero Mola.

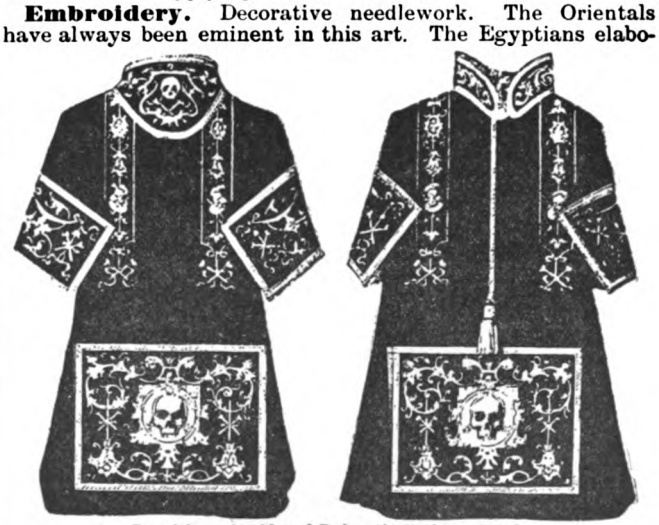
cloth and leather. Very beautiful examples of embossed metal work come from the East, and great artists were employed on mediæval armor.

Embracery. Common law offense of attempting to corrupt a juror; punishable by fine and imprisonment.

Embrasure. Opening made in a parapet so as to allow the gun to be fired under partial cover, and to have a range over a certain portion of the exterior ground. When the piece fires over the parapet the gun has a much wider range and is said to be mounted *en barbette*. The bottom surface of the embrasure is called the sole; the interior opening the mouth; the bisecting line of the sole the disectrix; the sides of the embrasure the cheeks, and the widening outward the splay.

Embrocation. Fluid medicinal preparation for application to the surface of the body in cases of sprains, bruises, etc.; also the act of applying.

Embroidery. Decorative needlework. The Orientals have always been eminent in this art. The Egyptians elabo-



Spanish embroidered Dalmatic (15th century).

rately embroidered their linen garments and mummy-cloths; the Jews similarly decorated their tabernacle hangings and priests' vestments. The Greeks, Phrygians, and Sidonians were all skilled in the art, and Babylonian embroideries commanded fabulous prices in Athens and Rome. At the Conquest the Peruvians astonished the Spaniards with their beautiful gold- and silver-embroidered feathers. Mediæval needlework reached its highest perfection in England, where noble ladies and their attendants used the needle principally in the service of the Church. Spanish embroidery also attained great excellence.

Embryo. Immature and developing young of animals, especially in stages passed in the egg; also initial plant contained in the seed.

Embryogeny. The development of embryos.

Embryography. Description of embryos.

Embryology. Study of embryos; science which investigates the development, or life history, of organic forms or of their organs. See DEVELOPMENT.

Embryonic Shield. Shield-shaped area of thickened blastoderm in the early stages of mesoblastic egg-development. In *Teleostei* and *Sauropsida* this first appears on one side of the disk-shaped blastoderm.

Embryo-Sac. That portion of the nucleus of the ovule containing the cells which develop into the embryo.

Embryotegium. Membrane capping the micropyle of certain seeds.

Embryotomy. Dissection of embryos; in surgery any operation upon the fœtus to reduce its size to facilitate its delivery.

Embury, MRS. EMMA CATHERINE (MANLEY), 1806–1863. American poet.

Embury, PHILIP, 1729–1775. Irish Wesleyan, who came to N. Y. 1760, began preaching there 1766, and founded the first Methodist Ch. in America, building part of it himself.

Emerald. Bright green precious stone. The Oriental emerald is green corundum; the common variety is beryl colored by chromium. The emerald (beryl) mines of Columbia yielded largely 1530–1800, but the present output is small. Fine Oriental emeralds have been found in N. C.

Emeraldine. Greenish black formed by the action of oxidizing agents, as chlorate of potassium, upon aniline. Its composition is not known, if indeed it is constant. It may be regarded as a step in the formation of aniline black by oxidation from aniline.

Emerald Nickel. Ni_3CO_5+6aq. Bright green hydrous carbonate of nickel, found with chromite in Lancaster co., Pa.; known also as Zaratite.

Emeritus. Term applied to officials, especially members of a faculty, who are retired on an allowance after honorable service.

Emersion. In Astronomy, the reappearance of a heavenly body after having been eclipsed.

Emerson, BENJAMIN KENDALL, Ph.D., b. 1843. Prof. Geology and Zoology at Amherst 1872.

Emerson, GEORGE BARRELL, LL.D., 1797–1881. Teacher in Boston. *Trees and Shrubs of Mass.*, 1846; *Agriculture*, 1861.

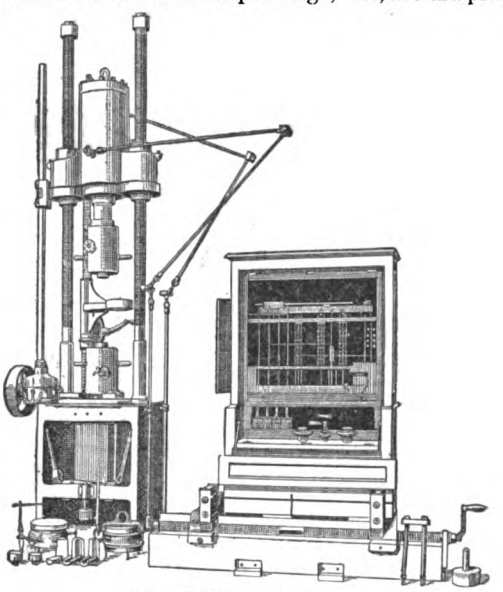
Emerson, RALPH WALDO, LL.D., 1803–1882. Poet, lecturer,

Ralph Waldo Emerson.

and essayist; Unitarian minister in Boston 1829–32. *Nature*, 1836; *Representative Men*, 1850; *English Traits*, 1856; *Conduct of Life*, 1860; *Society and Solitude*, 1870; *Social Aims*, 1875. His verse is orphic and unequal, but sometimes, as in *The Problem*, of the very finest; his prose is rather that of a poet than of a systematic thinker. He may be called a transcendental idealist; but the influence of his gentle and earnest optimism has been wide and deep. Matthew Arnold called him "the friend and helper of those who would live in the spirit."

Emery. Impure form of corundum, containing magnetite; used for polishing glass and metals.

Emery Testing Machine. Designed by Albert H. Emery to test the strength and physical properties of materials. The best known of the machines is at Watertown, Mass., with a capacity from 0 to 900,000 lbs. The strain is applied by a hydraulic press, and the record of strain is made at the recording scale beam by means of a system of reducing diaphragms so as to eliminate internal friction of packings, etc., around plungers.



Emery Testing Machine.

The machine also involves the use of plate fulcrums for the scale levers, instead of knife-edge supports as in the ordinary scale, with their attendant friction and deterioration. The absence of friction in the machine enables it to test the smallest and most delicate material as well as and after a specimen requiring the full straining capacity of the design.

Emery-Wheel. Wheel for grinding or polishing made of emery crystals cemented together by some suitable material to form a matrix for them. Such materials are feldspar, celluloid, japan varnish, glue, and silica, the requirements being that the cement shall not glaze, but yet shall be strong enough to hold the particles together. These wheels turn at high velocities, usually having a peripheral speed of ab. 3,500 feet per minute. They are specially used for fine tool-grinding, since their velocity enables them to be used very thin and of just the shape or section which is needed. For true work in hardened steel also the emery-wheel is better than a natural stone. It is much used in foundries for finishing castings.

Emetics. Medicines which cause vomiting.

Emeu, or EMU. See CURSORES (*Ratitæ*).

Emigration. Leaving one's native country to settle permanently in another; the process by which colonies are formed. Phœnician and Greek emigrants colonized the coasts of the Mediterranean and Black Sea. The discovery of America opened a vast field for European emigration. Gold in Australia and diamonds in S. Africa drew other streams of emigrants especially of British blood, but Asia so far has no European colonies proper. See IMMIGRATION.

Emigrés. French clergy and aristocracy who fled from the excesses of the Revolution July 1789. In Dec. their estates were confiscated. At the peace of Amiens, 1802, an amnesty was granted and many returned, and at the restoration of the monarchy, 1815, many received indemnities.

Eminence. Title given by Urban VIII. to Cardinals 1630.

Eminent Domain. Sovereign power of a State to take private property for public use. In the U. S. the power is generally exercised by State governments, but within constitutional limits it may be exercised by the Federal government. The State cannot divest itself of this power. Whether a particular use is public is a question for the courts; whether it is proper or wise to take particular property for a public use is a question for the jury.

Emin Pasha (EDWARD SCHNITZER), 1840–1892. Prussian physician. who entered the Egyptian service 1876; sent by Gen. Gordon to govern part of the Soudan 1878. He suppressed slavery, established schools and missions, and ruled 6,000,000

Emin Pasha in Camp.

people in Equatoria, but was involved in difficulties; rescued by Stanley 1889 and brought to Zanzibar. He returned, and was said to have defeated the Dervishes and reclaimed the Province, but was murdered.

Emir. Title in Asia and n. Africa of independent chiefs, and of supposed descendants of Mohammed's daughter Fatima.

Emission Theory. Corpuscular theory of light, advocated by Newton. See CORPUSCULAR THEORY.

Emmanuel, or IMMANUEL. "God with us;" name of the Messiah. Isa. vii. 14, viii. 8; Matt. i. 23.

Emmaus. Village 7 m. n.w. of Jerusalem, noted for our Lord's appearance to two disciples. Luke xxiv.

Emmenagogues. Medicines which promote menstruation.

Emmet, ROBERT, 1778–1803. Irish patriot, executed for heading a revolt in July, 1803. His speech at the trial was of memorable eloquence.—His brother, THOMAS ADDIS, LL.D., 1764–1827, was imprisoned 1798–1801, exiled, and became Atty.-gen. of N. Y. 1812.—His grandson and namesake, b. 1828, pub. *Gynecology*, 1879, tr. into German and French.

Emmetropia. State in which the accommodation being relaxed, the most remote objects are seen clearly and distinctly.

Emmius, URSO, 1547–1626. Dutch historian.

Emmons, EBENEZER, 1799–1863. Prof. Williams Coll. 1833–38; one of the four State geologists of N.Y., the n.e. part being assigned to him; founder of the so-called Taconic System; State geologist of N. C. 1858. *American Geology*, 1856.

Emmons, NATHANIEL, D.D., 1745–1840. Pastor at Franklin, Mass., 1773–1827; one of the leading New England theologians. His Works were collected in 7 vols. 1842.

Emmons, SAMUEL FRANKLIN, b. 1841. Assistant in U. S. Geological Survey 1867; in charge of Colorado division 1879. *Leadville*, 1886.

Emollients. Bodies such as starch, gum arabic, Irish moss, and other mucilaginous substances used to relieve irritation of mucous membranes, etc.

Emory, JOHN, D.D., 1789–1835. M. E. Bp. 1832.—His cousin, WILLIAM HEMSLEY, U.S.A., 1811–1887, was Gen. of Vols. 1862–65.

Emory College. Founded 1837 by the M. E. Ch. South at Oxford, Ga. It has 15 professors, ab. 300 students, and a fund of $225,000.

Empedocles, ab.490–ab.430 B.C. Greek philosopher, of Agrigentum, Sicily; predecessor of the atomists. He held to two opposing principles in nature, love and hate, or attraction and repulsion. He was a poet, a deep thinker, and a man of such repute and influence that he is said to have refused a crown. The tale of his suicide in Ætna is baseless.

Emperor. The commander of a Roman army was called *imperator:* thence the title passed to the monarchs, from Augustus to Theodosius, and to their successors in East and West. In modern times, a ruler over countries politically conjoined, as the German and Austrian Empires, or over a State with extended foreign possessions, as Great Britain, Russia, and France.

Emperor Moth. *Saturnia carpini.* Largest British moth except the Death's Head, with a wing expanse of 3 in. There is a ringed black ocellus on each wing. The caterpillar is hairy, green, and black-banded.

Emperor Moth, with Caterpillar, Pupa, and Cocoon.

Empetraceæ. Natural family of flowering plants, of the class *Angiospermæ* and sub-class *Dicotyledons*, comprising 3 genera and 4 species, natives of the temperate and frigid regions of the n. hemisphere; commonly called the Crowberry family.

Emphysema. Condition in which air or gases distend any of the cavities or tissues; commonly dilatation of air-vesicles of lungs or entrance of air into tissue between them.

Empirical Hedonism. That form of ethical theory in which the greatest happiness to the individual is looked upon as the proper end for his action, and the amount of happiness which any action will bring is sought for empirically, and not by any *a priori* method.

Empirical Knowledge of Conduct. Knowledge of what should be done, gained by comparing all pleasures and pains that can be foreseen as probable results of the different alternatives of conduct presented to us.

Empiricism. Theory which traces all knowledge to experience, and hence denies direct or intuitive knowledge.

Employé. One who is engaged to perform services for another, usually of a class higher than unskilled laborers, but not so high as officers or officials.

Employer. One who engages and pays another to perform services for him.

Employer's Liability Acts. Statutes in Britain and in some of the U. S., modifying the rule that a master is not liable to a servant for injuries caused by a fellow servant's negligence.

Empress of India. Title assumed by Queen Victoria under the influence of Disraeli May 1, 1876; proclaimed at Delhi Jan. 1, 1877.

Empson, SIR RICHARD, d. 1510. Speaker of the Commons 1491; agent, with E. Dudley, of Henry VII.'s exactions; beheaded.

Empyema. Collection of pus in a natural cavity of the body, usually in the chest.

Empyreumatic Oils. Prepared by the destructive distillation of organic substances; *i.e.*, by heating them in a vessel from which air is excluded.

Ems. Fashionable watering place in Hesse-Nassau, on the

Ems.

Lahn; known to the Romans, and popular since ab. 1350. It has warm springs, 80°–135° F., containing soda. Pop. 6,356.

Emser, HIERONYMUS, 1477–1527. German opponent of Luther, in whose Bible he pointed out 1,400 errors. He tr. the Vulgate 1527. His works were collected 1890.

Emu. See EMEU.

Emulsion. Fluid in which minutely divided gum, fat, or resin is suspended. Fats are emulsified in digestion, preparatory to their absorption.

Emydidæ (TERRAPINS). Family of *Chelonia*, having flat carapace and small plastron. The feet have movable, webbed toes. They are amphibious, fresh-water tortoises, mostly American, including 60 species, some of which live on the seashore; others are terrestrial. Here are included: 1. The Red-bellied Terrapin (*Pseudemys*) of the coasts of N. J. and Md. 2. The Diamond-back (*Malacoclemmys*), famed in the cuisine of the Eastern U. S. 3. The Painted Terrapin (*Chrysemys picta*), with its yellow and red markings, widely distributed e. of the Mississippi; it may attain a length of 8 in. 4. *Chelopus guttatus*, the yellow-spotted, and *C. insculpta*, the sculptured Wood Terrapin or Tortoise. 6. *Cistudo*, the Box Tortoise, whose plastron has two lids (one, in *Emys*, of Wisconsin). It feeds on mushrooms, and lives to a great age.

Enaliosauria. Order of extinct *Hydrosauria*, with naked leathery skin, amphicœlous (biconcave) vertebræ, and swimming fins. The body and snout are very long. They lived in the Secondary period, and included the *Sauropterygii* and *Ichthyopterygii*. *Plesiosaurus* and *Ichthyosaurus* illustrate the two groups.

Enamel. Hard substance, made up of microscopic hexagonal prisms with intervening spaces, which covers the crown of a tooth.

Enamel. Practice of fusing vitrified substances for color decoration on metal; credited to Egypt, where the art was practiced in great perfection. Fine specimens were found at Mycenæ by Dr. Schliemann, certainly of Egyptian export or made under Egyptian influence. In the Oriental world, in the Byzantine Empire, and in the Mediæval period, the art was extensively practiced. At present it is best understood in Japan. Here the *Cloisonné* method prevails; this lays down a pattern in fine wire, which is soldered to the metal (generally copper) surface. The various colors, in powdered vitreous substances, are then distributed and subsequently fused. *Champlevé* enamel was much employed in the Middle Ages, especially at Limoges. The figures and designs are cut out of the metal, leaving raised partitions, to avoid the mixing of the different colors when fused. Painting in enamel on enamel ground over metal was practiced by the later Limoges School from ab. 1400. Translucent enamel over low metal relief was practiced in the Italian Renaissance. The enameling of terra cotta reliefs was brought to perfection by the Robbia family in Italy, 15th century. The art of enameling tiles and terra cotta is also of high antiquity, and traceable to Egypt and Chaldea. It was practiced with rare success by the Assyrians, Persians, and Arabs.

Celadon jar, Cloisonné.

Enargite. Cu_3AsS_4. Copper sulpharsenate, found in Peru and at several localities in the w. U. S.

Enarthrosis. Joint in which a globular process of one bone is received into a spherical depression in another.

Enation. In Botany, outgrowths from the sides of organs.

Enault, LOUIS, b. 1824. French journalist and romancer.

Encampment. Location of troops for temporary repose in tents or in bivouac. When distributed among villages or in huts at the end of a campaign, they are in cantonment. When in barracks, they are in permanent military quarters.

Encaustic Painting. Method practiced in ancient art, of applying colors mixed with wax to a prepared surface, into which they were subsequently burned.

Enceinte. That part of a fortification which incloses, by a continuous line, the main position to be defended; also called body of the place or main inclosure. With the outworks, detached works, and communications, it constitutes the complete fortification.

Enceladus. One of the 100-armed giants who made war on the gods; slain by Jupiter and buried under Ætna.

Encephala. See CEPHALOPHORA.

Encephalitis. Inflammation of the substance of the brain, causing pain, fever, delirium, convulsions, and coma: of infrequent occurrence, and nearly always fatal.

Encephaloma. Encephaloid tumor or cancer, having a soft spongy texture like that of the brain.

Encephalon. See BRAIN.

Enchylema (CELL SAP, NUCLEAR SAP). Fluid of protoplasmic nature, present in cells and their nuclei, but not entering into any definite structures, such as the reticulum. It often contains suspended granules of various composition. It is obtained from protoplasm on subjecting it to high pressure. It forms ab. two-thirds by weight of fresh protoplasm, and has a specific gravity of ab. 1.2.

Encina, or ENZINA, JUAN DEL, ab. 1469–1534. Spanish poet, author of the first secular plays, 1492.

Enciso, MARTIN FERNANDEZ DE, ab. 1470–ab. 1530. Spanish settler at St. Domingo 1500; founder of Darien 1510; first writer on America in *Suma de Geografia*, 1519.

Encke, JOHANN FRANZ, 1791–1865. Director Berlin Observatory 1825–64; author of valuable astronomical papers; ed. *Astronomisches Jahrbuch*, 1830. The comet named after him was seen 1786, 1795, 1805, and 1818.

Encouragement of Industry. Intervention of government to promote, by protective tariffs, bounties, or otherwise, certain branches of national production.

Encratites. Gnostic ascetics of 2d century and later, celibates, vegetarians, and total abstainers.

Encrinites. Group of Crinoids with smooth sub-cylindrical stems, often CRINOIDS (q.v.) in general.

Encrinite Stems (Mountain Limestone).

Encyclical. Papal letter to all R. C. bishops.

Encyclopedists. Contributors to the *Encyclopédie* 1751–77, conducted by Diderot and D'Alembert. Besides these, they were Rousseau, Voltaire, Grimm, d'Holbach, Helvetius, Dumarsais, and Jancourt.

Encystation. Process undergone by *Protozoa* and other minute animals, in which a cyst or bag-like structure is formed about the organism for purposes of protection during "resting stages," or while important internal and reproductive changes take place.

End. In Philosophy, consequence intended, aimed at, purposed, or designed; object for which any given means is employed.—In Ethics, it is the object of volition, and may be subordinate or ultimate. The latter is the fundamental principle by which the merit of all conduct is determined.

End, OF COAL. See BUTT.

Endarteritis. Inflammation of the lining of arteries.

Endelechius, SEVERUS SANCTUS. Roman poet ab. 390.

Endemic. Occurring naturally and often in a certain region. In Botany and Zoölogy, organisms which are indigenous within only a limited area.

Enderby Land. Part of the Antarctic Continent, or an island, discovered by Biscoe 1831. Ice prevented an approach within 30 m. of the shore.

Endermic Medication. Application of medicines to a raw surface, by which they are absorbed.

Enderon. Inner layer of the ectoderm in Cœlenterates.

Endicott, JOHN, 1589–1665. Gov. of Mass. 1644, 1649–53, and 1655–65.

Endicott, WILLIAM CROWNINSHIELD, b. 1827. Justice Mass. Supreme Court 1873–82; U. S. Sec. of War 1885–89.

Endive. *Cichorium endivia*. Herb of the Composite family, native of Asia, extensively cultivated for a salad plant.

Endless Screw. Screw whose action is continuous, engaging the teeth of a wheel which is revolved thereby. Used in graduating machines or any other place where a means of slow and positive rotation to a wheel is required. See WORM-WHEEL.

Endlicher, STEPHAN LADISLAUS, 1804–1849. Prof. Vienna 1840. *Genera Plantarum*, 1836–40; *Enchiridian Botanicum*, 1841; *Synopsis Coniferarum*, 1847.

Endobasidium. In Mycology, inclosed basidium in the order *Basidiomycetes*.

Endocardium. Thin membrane lining the interior of the heart and continuous with that lining blood-vessels. When

inflamed, a frequent condition in acute rheumatism, the state is known as Endocarditis.

Endocarp. Inner layer of the pericarp or seed-vessel.

Endochone. See SUBDERMAL CHAMBERS OF SPONGES.

Endochrome. Chlorophyll of the *Diatomaceæ* and *Desmidiaceæ*.

Endocranium. Cartilaginous cranium.

Endocyclica, or REGULARIA. Sea urchins, of globular or sub-globular form, with the mouth at one pole and furnished with teeth, and the anus at the opposite pole surrounded by the genital plates. There are two groups, the *Cidaridea* and *Echinothuridea*. The latter are distinguished by imbricated plates to the shell, so that it is flexible.

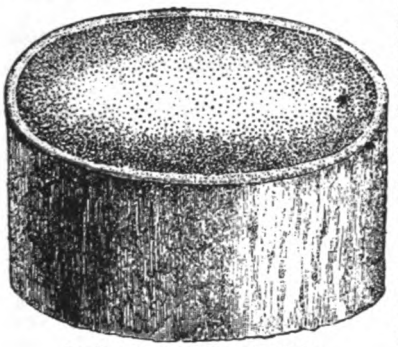
Endocyst. Inner layer (endoderm) of the investing sac of a Polyzoön.

Endoderm. Hypoblast or internal of the layers into which nearly all fecundated ova divide, and from which is developed the epithelium of nearly all the alimentary canal, that of the glands connected with it, and that of the air-passages.

Endodermis. Layer of cutinized cells occurring in certain plants just within the bark-layers.

Endogenæ. See MONOCOTYLEDONS.

Endogenous. Vegetable stem which increases in diameter from within, consisting of greatly elongated fibers of prosenchyma or woody tissue, imbedded in the pithy or parenchymous tissue which forms the ground-mass of the structure, as in the Palm, Lily, and Bamboo.



Section of the Stem of a Palm.

Endognathal Palp. Outer three joints of the endopodite, borne on the modified proximal joints used as jaws in Arthropods.

Endogonidium. Gonidium contained within a sac, as in some moulds.

Endolymph. Fluid in the membranous labyrinth of the ear.

Endometritis. Inflammation of the mucous membrane, the Endometrium, lining the uterus.

Endomorph. One mineral inclosed by another, occurring frequently in the crystalline schists and igneous rocks.

Endoparasites. Parasites living within the body; *e.g.*, Tape-worms.

Endoperidium. In Mycology, inner peridium, as in some *Gasteromycetes*.

Endophlœum. Inner layer of the bark of an exogenous stem; liber, or fibrous inner bark, as in the Linden or Basswood.

Endophytic. Growing entirely within the cells of plants, as with many Fungi.

Endoplasm, or ENDOSARC. Internal, more fluid portion of the cell body of *Protozoa*.

Endoplasm. Granular portion of the protoplasm of a vegetable cell, found in its interior, not directly in contact with the cell-wall.

Endoplastica. *Protozoa* having a manifest nucleus.

Endoplasts. Nuclei or larger chromatin bodies present in some ciliated Infusoria.

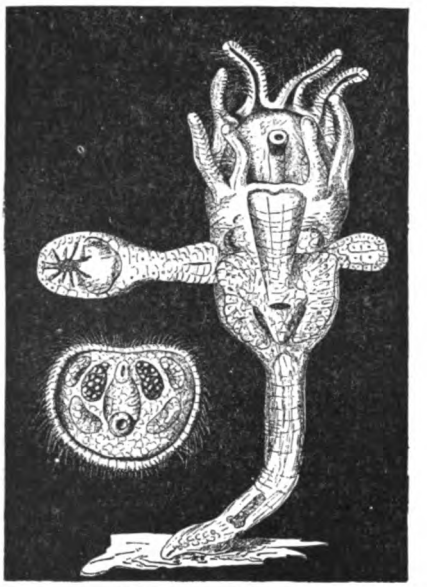
Endoplastules. Paranuclei, or smaller chromatin bodies, present in certain *Infusoria*.

Endopleura. Inner seed-coat or tegmen.

Endopleurites. Apodemes which arise from the pleura or epimeral surface of Crabs and Lobsters.

Endopodite. Inner or more mesially situated of the two appendages borne by the protopodite of the Crab's appendages. It is typically five-jointed, and is alone present in the walking legs of Crabs and Lobsters.

Endoprocta, or ENTOPROCTA. *Bryozoa* with the anus within the circle of tentacles. Only a few forms are included. *Loxosoma*, a solitary, long-stalked Bryozoan, and *Pedicellina*,



Loxosoma cochlear.

also long-stalked, but growing on stolons, are the chief representatives.

Endopterygoid. Inner piece of the pterygoid bones in fishes.

Endor, WITCH OF. Woman consulted by King Saul the night before his defeat and death. She called up Samuel to announce Saul's fate. (I Sam. xxviii.)

Endorhizal. Embryo whose radicle is sheathed by the cotyledons.

Endorse. See INDORSE.

Endosarc. See ENDOPLASM.

Endoscopy. Examination of the interior of an organ (*e.g.*, bladder) or cavity by means of reflectors, etc.

Endoskeleton. Structure, whether bony, cartilaginous, or calcareous, in the interior of the body, which it serves to support. In the higher animals (*Vertebrata*) it forms the whole skeleton.

Endosmosis. Passage of fluids through an animal membrane into a cavity; *e.g.*, of digested food into the circulation. See OSMOSE.

Endosmotic Equivalent. Ratio of the exosmose to the endosmose in the phenomenon of Osmose, if one of the fluids be water.

Endosome. Inner part of a sponge along the excurrent canals, etc., all the parts within the portion occupied by ampullæ.

Endosperm. Starchy and other nutrient matters developed within the embryo-sac of the ovule. See ALBUMEN.

Endospore. Spherical body produced inside a bacterium cell, especially during the zoogloœa stage.—In Botany, inner cell-wall of the spores of Ferns, etc.

Endosternites. Apodemata which arise by the infolding of the sternal area of the Crab's or Lobster's shell.

Endostome. System of transverse or longitudinal ridges around the mouth of the sporange in certain mosses. Also, the orifice through the inner coat of an ovule, forming the inner portion of the foramen.

Endostosis. Ossification of cartilage into bone by deposits of earthy matter in its substance interiorly.

Endostracum. Innermost and thickest layer of the Crab's shell.

Endostyle. Ciliated groove on the ventral side of the pharyngeal sac in Tunicates.

Endotheca. Innermost layer of the perigonium of the sporosac of Hydroids.

Endothecium. Inner layers of cells of an anther sac.

Endothelium. Layer of flat cells lining blood vessels, cavities of the joints, etc.

Endothermal Reaction. In Chemistry, when certain compounds are formed from the elements or by the decompo-

sition of other compounds, a quantity of heat is absorbed or rendered latent in their formation. If the reverse should happen and heat be evolved, the reaction would be called Exothermal.

Endymion. Youth of Mt. Latmos in Caria doomed by

Endymion.

Jupiter to perpetual sleep; beloved by Selene (or Luna, the Moon).

Enema. Injection or fluid preparation introduced into the rectum by a syringe; used to excite movements of the bowels, to apply remedies, or to furnish nourishment, when the stomach rejects it or is diseased.

Enemy. State which is at war with another State, or with a subject of either.

Energetics. Science of energy and work; combination of kinematics and dynamics, treating of the effects of force in general on any body whatever.

Energy, KINETIC. Work that a moving body is capable of performing by virtue of its mass and velocity before being brought to rest. If W be the weight of the body, v its velocity, and g the acceleration of gravity, its kinetic energy is $W\frac{v^2}{2g}$. Rankine terms it, the actual energy, and Thomson dynamical energy (Thomson and Tait kinetic energy).

Energy OF A STORM. Total or average characteristic of a system of cyclonic winds. A storm of great energy is one whose winds are on the average very strong.

Energy OF THE SOLAR RADIATION. Given by Young as 100,000 horse-power per sq. meter of surface.

Energy, POTENTIAL. Work that a body is capable of performing by virtue of its height above a point upon which it can fall. If W be the weight of the body, and h that height, its potential energy is Wh. If the body fall through the distance h, the potential energy becomes kinetic. What Rankine has called potential energy has been named the sum of the tensions by Helmholtz and statical energy by Thomson. The same property of a moving mass was called by Leibnitz its vis viva.

Enfantin, BARTHELEMY PROSPER, 1796–1864. Disciple of SAINT-SIMON (q.v.), whose ideas he expounded in several books 1830–31, and strove to apply; imprisoned 1832. *Algeria*, 1843.

Enfield, WILLIAM. LL.D., 1741–1797. English dissenter; adapter of Brucker's *Hist. Philosophy*, 1791.

Enfield Rifle-Musket. British infantry arm from ab. 1853 till the adoption of the breech loader. It was used during the Crimean War, and large numbers were imported to the U. S. 1861–65. Its barrel had three grooves, each having one turn in 6 ft.

Enfilade. Defensive line is said to be subject to enfilade fire, when its prolongation falls within a position that can be occupied by the enemy's infantry or artillery. The defenders of such a line are then subject to a flank fire, and can retain their position only by interposing traverses at suitable intervals along the line. Enfilading batteries are those whose crests are perpendicular to the enemy's line of defense and see it in flank and reverse.

Engadine. Swiss valley, in canton Grisons; length ab. 65 m., ht. 3,340 to 6,090 ft. The Upper E. has fine pasturage and a superior climate to the Lower. St. Moritz is much resorted to by foreign invalids, and other villages have lately become very fashionable haunts.

Baths and Lake of St. Moritz, Upper Engadine.

Engagement. Battle, occurring when two hostile forces at sea or on land come sufficiently near each other to open a destructive fire, and generally continuing till one or the other yields its military position or surrenders.

Eng and Chang, 1811–1870. The Siamese Twins; their names mean Right and Left. They were connected near the navel by a band 8 in. in diameter, but otherwise had entirely separate lives. Eng died of nervous shock at his brother's sudden death by paralysis.

Engel, ERNST, b. 1821. Director Prussian statistics 1860–82.

Engel, JOHANN JAKOB. 1741–1802. German novelist, Prof. Berlin 1776. *Lorenz Stark*, 1795.

Engel, JOSEPH. b. 1816. Prof. of Anatomy at Zurich 1844, Prague 1849, and Vienna 1854.

Engelbert, ST., 1185–1225. Abp. of Cologne 1216; Count of Berg; founder of Vehmgericht and of Cologne cathedral; assassinated; celebrated by Walter von Vogelweide.

Engelbrecht, JOHANN, 1599–1642. German visionary. *Divine Visions*, tr. 1780.

Engelhardt, JOHANN, 1791–1855. Prof. Erlangan 1822. *Ch. History*, 4 vols., 1834; *Hist. Doctrine*, 1839.

Engelmann, GEORGE, 1809–1884. Physician and Botanist in St. Louis from 1835. *Cactaceæ of the U. S.*, 1856; *Genus Cuscuta*, 1860; *Genus Juncus*, 1868.

Engels, FRIEDRICH, b. 1818. German-English Socialist. *Laboring Classes in England*, 1845.

Engen. In Baden; scene of defeat of Austrians, May 3, 1800, by French under Moreau.

Enghien, LOUIS ANTOINE HENRI DE BOURBON, DUC D', 1772–1804. Grandson of Prince of Condé, under whom he served

Execution of the Duc D'Enghien in the fosse of Vincennes.

against the French Republic 1792–99; seized by Bonaparte's order in Baden, and shot on a charge of conspiracy.

Engine, AIR. See AIR ENGINE.

Engine, COMBINED. See COMBINED VAPOR ENGINE.

Engine, CALORIC. See CALORIC ENGINE.

Engine, COMPOUND. See COMPOUND ENGINE.

Engine, CONDENSING. See CONDENSING ENGINE.

Engine, GAS. See GAS ENGINE.

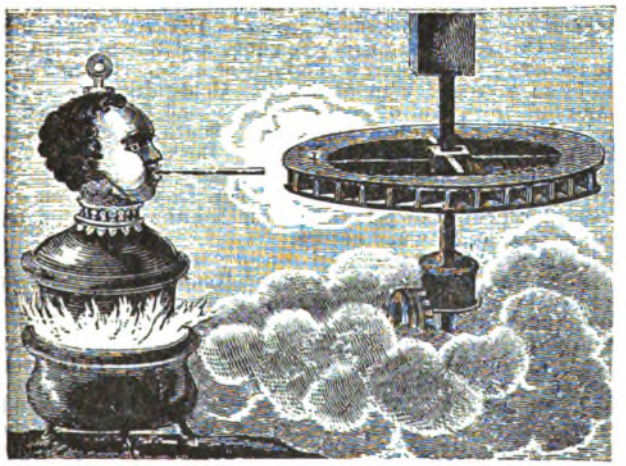
Engine, HIGH-PRESSURE. Term formerly synonymous with Non-Condensing Engine, and often so used to-day. In early practice, when weak boilers admitted only of very low steam-pressures, an engine which did not condense its steam would have to carry a higher steam-pressure than those which did most of their work on the vacuum in the cylinder after condensation. Hence in those days non-condensing engines were high-pressure engines, and the terms could be used indifferently. Now, however, many condensing-engines carry as high steam-pressures as any other kind, and high-pressure is not synonymous with non-condensing, except in the compound engine.

Engine, LOW-PRESSURE. Term synonymous with Condensing Engine, but misleading, since many condensing engines run with high steam-pressures. In the compound engine, the pressure in the small cylinder is high, relatively to the lower pressures in the larger cylinder, and hence there is less ambiguity in the use of L. P. and H. P. for the cylinders of this type of engine.

Engine, MULTIPLE-EXPANSION. See TRIPLE-EXPANSION ENGINE.

Engine, TRIPLE-EXPANSION. See TRIPLE-EXPANSION ENGINE.

Engine, STEAM, HISTORY OF. The earliest account on record of the utilization of steam to convey heat to a motor is given by Hero of Alexandria ab. 130 B.C. His engine was a reaction wheel, and he also raised water by pressure of heated vapor on its surface in a closed vessel. Giovanni Battista della Porta repeated Hero's apparatus 1601, adding the aspiration of water by condensation of steam in a closed vessel. Solomon De Caus of France in 1615 described again the raising of water by steam pressing on its surface in a heated closed vessel; Branca in 1629 utilized the impulse of steam from a nozzle to turn a wheel with vanes; the Marquis of Worcester in 1633 described De Caus's machine, but added a boiler separate from the water-chamber. Savery in 1697 invented a pumping-engine, which was applied in mine practice, in which alternately the water was lifted by forming a vacuum and expelled by steam-pressure, exerted however direct upon the water. Denis Papin, who invented the safety-valve, proposed the use of a piston to keep the steam from the water in pumping, and proposed to produce rotary motion by racks and ratchet gear ab. 1690. In 1705 Newcomen combined with Savery and Cawley to produce



Branca's Engine.

their atmospheric pumping-engine, using a cylinder and piston, a separate boiler and surface and jet condensation in the cylinder. Humphrey Potter and Beighton introduced and improved self-acting valve-gear, and Smeaton up to 1770 did much to improve details. The high-pressure principle without condensation was proposed 1725 by Leupold. In 1769 James Watt invented the separate condenser, and the plan of expansive working of steam; in 1782 he patented the double-acting engine, and in 1784 the governor and indicator. The double-cylinder engine was due to Hornblower 1781, and the compound engine to Woolf a few years later. The locomotive-engine was proposed by Watt 1784, built first by Trevithick 1804, and improved by George Stephenson by combining the tubular boiler of Seguin of France and Booth of England with the blast-pipe in the stack, in various years up to 1829. Marine propulsion, before the perfection of the rotative engine by Watt, embraces the attempts in France by the Marquis de Jouffroy in 1781 and 1783, and of Rumsey and Fitch 1783 in America. Symington's *Charlotte Dundas* in Scotland, 1801, was a practical success, and Fulton's first paddle steamer in this country dates from 1803. In 1804 Stevens ran a boat with a screw-propeller, and in 1807 Fulton's *Clermont* was built.

Engineer, MILITARY. Officer technically educated to project fortifications, oversee their construction, plan attacks against fortified places, locate and build military bridges and make military reconnoissances and surveys. In the U. S. Service he often acts as military adviser to the commander of an army in strategical operations and grand tactical maneuvers.

Engineering. Art of construction: divided into (1) civil, devoted to public works; (2) mechanical, which deals with prime motors and machinery; (3) mining, devoted to the production and utilization of ores; and (4) electrical, which comprises the industrial applications of electricity. Other subdivisions sometimes recognized are: hydraulic, sanitary, railroad, and bridge, which are branches of the broad field of civil engineering. Military engineering includes constructions intended for purposes of war. In early times all engineering was under the charge of army officers; the Roman roads, *e.g.*, being built by soldiers in times of peace. Telford, the founder of the oldest engineering society, defined engineering to be the art of utilizing the forces and materials of nature for the benefit of man. See CIVIL ENGINEERING.

Engineering Literature. This has mostly appeared since 1800, but it now numbers thousands of volumes and hundreds of technical periodicals. The *Descriptive Index of Engineering Literature*, pub. by the Association of U. S. Engineering Societies, gives a synopsis of current articles in technical journals and transactions of societies. A somewhat more comprehensive index is Kerl's annual *Repertorium der Technischen Litteratur*.

Engineers, CORPS OF. Body of officers, honor graduates of U. S. Military Academy. Their duties comprise reconnoitering and surveying for military purposes; the selection of sites and formation of plans and estimates for military defenses; the construction and repair of fortifications and their accessories of every description; the planning and superintending of defensive or offensive works of troops in the field; the examination of water of communications for supplies and for military movements, and the construction of military roads and bridges; also for the execution of river and harbor improvements assigned to it, and such other duties as the President may order. It collects, arranges and preserves all correspondence, reports, memoirs, estimates, plans, drawings, deeds, titles, and models which relate to these duties. The Corps of Engineers consists of 1 brigade-general, 6 colonels, 12 lieutenant-colonels, 24 majors, 30 captains, 26 first lieutenants and 10 second lieutenants. There is also a battalion of engineer troops officered by the Corps, having headquarters at Willet's Point in N. Y. Harbor, the school of application for engineers.

England. Southern and larger part of GREAT BRITAIN (q.v.); originally inhabited by Celts; known to Phœnicians; conquered by Cæsar 55 B.C. Roman civilization was extensively introduced. The Romans withdrew ab. 420, and the Romanized inhabitants invited the Saxons to defend them against the Picts and Scots; these remained and others followed, Jutes, Angles, and Saxons, who subdued the country and established the Heptarchy. E. was consolidated under Egbert of Wessex ab. 830; conquered by the Danes under Cnute 1017–41; by William the Norman 1066, who laid the foundation of the modern kingdom and made it a European power. The Plantagenets ascended the throne with Henry II., great-grandson of William, 1155. His vast estates in France were lost by John, 1199–1216, who conceded to the barons the charter of English liberty. Out of the contest with the barons grew the English Parliament, founded by the Earl of Leicester. The 100 years' war with France strengthened the power of Parliament, and fused Norman and Saxon into one people. E. then took its modern shape. The War of the Roses, 1455–85, diminished the nobility and threw a greatly enhanced power into the hands of Henry VII., who united the opposing families. The tendency to absolutism was reflected in Henry VIII., 1519–47. He separated the Ch. from Rome, and was conspicuous in the continental complications. Under Elizabeth, 1588–1603, the ecclesiastical character of the realm was fixed and the acme of intellectual brilliancy was obtained. With James I. the conflict between Royalty and Parliament began, culminating in the execution of Charles I., Jan. 30, 1649. The Commonwealth followed, with Cromwell as Protector. The royalist reaction

restored Charles II., 1660, and the old contest was revived under James II. 1685, who was deposed 1688. Under William III. (of Orange) the career of Louis XIV. of France was effectually checked. The union with Scotland 1707 formed Great Britain. The house of Brunswick-Luneburg (Hanover) succeeded with George I., 1713. Great colonial possessions were acquired, and the foundations of the Empire in India laid; but most of the American colonies were lost 1776–83. E. took an active part in the wars of Napoleon, and overthrew him at Waterloo 1815. Since then English policy has been directed to territorial extension and domestic reform. The Crimean war, 1854–55, was occasioned by Russia's encroachments in the East. Occasional wars in defense of her dependencies have not disturbed E.'s prosperity, nor have reforms shaken her stability. Area 50,840 sq. m. Pop., 1891, 27,483,490, to which WALES (q.v.) adds 1,518,914.

England, CHURCH OF. Founded in 1st or 2d century; revised and greatly extended by St. Augustine 597; partially reformed under Henry VIII. and Edward VI.; finally detached from Rome on Elizabeth's accession 1558; suspended under the Commonwealth 1643–60. It includes 2 provinces, 32 sees, ab. 26,000 clergy, and fully half the population. In the British colonies and elsewhere it is represented by ab. 75 bishops and 4,000 clergy.

England, JOHN, D.D., 1786–1842. Irish R. C. journalist; head of a theol. sem. at Cork 1809; Bp. of Charleston 1820; founder of provincial councils in the U. S., and a prelate of great influence. *Works*, 5 vols., 1849.

England, SIR RICHARD, ab. 1750–1812. Irish officer in the American war; commandant at Detroit.—His son, SIR RICHARD, 1793–1883, served in the Crimean and other wars, became lieut.-gen. 1855, and general 1863.

English, EARL, U.S.N., 1824–1893. Commander 1866; captain 1871, commodore 1880, rear-admiral 1884.

English, GEORGE BETHUNE, 1787–1828. American officer in Egyptian service 1820–26. *Expedition to Dongola*, 1822.

English, JAMES EDWARD, 1812–1890. M. C. 1861–65; Gov. of Conn. 1867–71; U. S. Senator 1875–76.

English, THOMAS DUNN, M.D., LL.D., b. 1819. American author and journalist, M. C. 1891. He wrote the song, *Ben Bolt*, 1843. *Ballads*, 1882.

English, WILLIAM HAYDEN, b. 1822. M. C. from Ind. 1852–60; Democratic candidate for Vice-Pres. 1880.

English Channel. Sound separating England from France; width 21 to 150 miles.

English Horn. Musical instrument of the double-reed family, standing midway between the OBOE (q.v.) and BASSOON (q.v.). It is longer than the oboe, and bent to enable the player to govern the finger-holes. The inventor is unknown. One of its most effective uses is in the pastoral melody in the overture to Rossini's *William Tell*.

English Language: Branch of the Germanic or Teutonic family. 1. The foundation is Anglo-Saxon (called "Old English" by Freeman, Sweet, and many others), made up of several dialects, mainly Saxon in the s. of England, and Anglian in the e. and n., brought to Britain by the Low-German invaders. The earliest additions to this Germanic stock were Latin words—(a) brought from Germany, and derived from traders and soldiers of the Empire, or (b) found in Britain as results of Roman rule (*castra-* in Chester or Lancaster; *street*, etc.), or (c) introduced with the Christian religion (*candle*, *bishop*, etc.)—together with a few Celtic words. The Danish raids and settlements gave the language a few words, such as the important verbal form *are*. It was the Norman Conquest, however, which, after a time of separate existence of the two tongues side by side, brought about the fusion of Norman and Saxon, and made the most important change in the language. This introduced an enormous amount of Norman-French words, and hastened, if it did not cause, the breaking-up of inflections, fairly abundant in the older styles of English, with other changes, such as in the order of words in the sentence. In any case, the language rapidly became analytic, and lost the bulk of its inflections.—In modern times, the additions to our vocabulary have been varied; the vast majority are from the Latin and Greek, due in the latter case to the needs of science; but countless foreign articles, customs, and the like, made familiar in England, have kept their foreign names. 2. The Periods of the Language are: (a) Anglo-Saxon or Old English, from ab. 450 to 1100; there is no literature or record of this tongue until ab. 700, and there is a marked division into Early and Late Anglo-Saxon, with a dividing-line ab. 900; (b) Middle English, from 1100 to 1400, with one century (till 1200) for transition, another for the dialect literature to 1300, and finally the beginnings of modern literary English with Chaucer and Wyclif, to 1400; (c) Modern English, with the century to 1500 as a time of transition. 3. The character of the language gains from the fusion of Saxon and Norman; nor can the words directly taken from Latin be regarded as anything but an element of strength, if judiciously used. In actual number, the Saxon words are in a minority; in use they far outnumber all other elements in the language.

English Literature. In its earliest developments this is characterized by the variety of its forms as to language. That of Anglo-Saxon is comparatively scanty, existing mainly in the poem of *Beowulf*, the verses of Caedmon, and the translations of King Alfred. Welsh scholars claim that there was an early Celtic poetry in the production of the bards, which in point of age should rank with Anglo-Saxon. Then came the Anglo-Norman period, in which certain monks wrote Latin chronicles. French metrical romances were written in England in the 13th and 14th centuries, and Walter Map (or Mapes) and others contributed to the cycle of Arthurian romances.

Norman-French was in time displaced by the vernacular. Through an intermediary stage, called Semi-Saxon, we reach the early English of Langland (*Piers Ploughman*), Wyclif, Gower, and Chaucer. With this great poet the history of English literature proper really begins. Between Chaucer and Spenser a century and a half intervene, barren on English soil, while north of the Tweed Barbour and Dunbar kept alive the poetic spirit which Chaucer had stimulated.

Spenser ushered in the Elizabethan age by *The Faery Queen*. The glory of this age is its drama, with Shakespeare as its head. Before him came Marlowe, and after him Jonson, Ford, Webster, Massinger, Beaumont and Fletcher. English prose had at this time such lights as Hooker and Bacon.

The 17th century is notable for a school of sacred poets, Quarles, Herbert, Wither, and others, with Crashaw and Vaughan later. Greater than these was Milton, whose *Paradise Lost* remains the first of modern epics. Cowley and Waller enjoyed a fame now much faded. The dignity of prose was maintained by Jeremy Taylor, "the Shakespeare of divines," Sir T. Browne, I. Walton, and J. Fuller. In the abundant polemic literature of this age, as in its poetry, Milton is the greatest name. Clarendon won repute as a historian, and Baxter as a religious writer. Bunyan's *Pilgrim's Progress* is the first of allegories. In this age journalism began on a small scale.

The Restoration called forth Butler's *Hudibras*, a strong and coarse satire on the Puritans, and made room for the witty and indecent plays of Etheredge, Wycherley, Congreve, Vanburgh, and Farquhar. Dryden is the last great name of the 17th century; his least fame is that of a dramatist. Locke and Newton, pre-eminent in science, belong also to the succeeding age.

The influence of Pope, "classic," coolly intellectual, and brilliantly uninspired, was supreme in his day. Thomson's *Seasons* and Young's *Night Thoughts* were long popular. Prior, Collins, Gay, and Shenstone were minor poets; Gray's *Elegy* is still unequaled. Watts and C. Wesley brought hymns into extensive use. Addison, with Steele's help, reformed and purified English prose. Swift, on the contrary, was one of the coarsest though most virile of writers. DeFoe produced much besides *Crusoe*. Richardson, Fielding, and Smollett initiated the modern novel. Sterne won fame as a humorist, and Johnson as an all-round man of letters. Goldsmith was another man-of-all-work and of genius. Hume and Gibbon head the great school of English historians. South, Burnet, Butler, and later Paley, in religious writing, Burke in oratory, and Adam Smith in economy, are memorable. The latter part of the century was marked by a reaction from the French or classical school; Cowper and Burns led the transition from artifice to simplicity and nature.

The early part of the 19th century was illumined by the great names of Byron, Shelley, and Keats. These were outlived by Wordsworth (at his rare best the equal of any), Coleridge and Southey; the two last did as much or more in prose than in verse. Scott (as a poet), Crabbe, Campbell, and Rogers began earlier. Heber and James Montgomery are remembered by their hymns; the fame of Mrs. Hemans and Miss Landon is chiefly of the past. Hood's pathetic lyrics have outlived his jests. Later than these arose Tennyson, the most finished, and Browning, the most intellectual, of poets; Mrs. Browning, M. Arnold, Clough, Swinburne, W. Morris, and a host of lesser lights.

In fiction, the most prominent and popular form of current literature, the great names are Scott, Dickens, Thackeray, and George Eliot; after them in rank, Jane Austen, Bulwer, Disraeli, Reade, C. and H. Kingsley, and Trollope. It is too early yet to determine the position of Stevenson, or of living writers like Hardy, Blackmore, Black, Besant, Mrs. Oliphant, Mrs. Ward, Haggard, Kipling, and Weyman, though several of these have exhibited very great ability.

In history, Macaulay, Carlyle, Froude, and Green are brilliant; Hallam, Milman, and Freeman are solid; Buckle and Lecky occupy a field of their own. As essayists or critics,

ENGLAND & WALES
British Miles
0 5 10 20 30 40 50 60 70
Towns of upwards of 100,000 inhabitants shown thus ■
from 50,000 to 100,000 ●
from 10,000 to 50,000 ⊙
below 10,000 ○
County Towns underlined
Railways shown thus
SCOTLAND
ENGLAND
WALES
IRELAND
FRANCE
NORTH CHANNEL
FIRTH OF CLYDE
SOLWAY FIRTH
ST. GEORGE'S CHANNEL
BRISTOL CHANNEL
ENGLISH CHANNEL
STRAIT OF DOVER
EDINBURGH
Glasgow
Leith
Greenock
Berwick
Peebles
Carstairs Jun.
Coldstream
Kelso
Flodden
Belford
HOLY I.
FARNE IS.
Ayr
ARRAN
AILSA CRAIG
Girvan
Hawick
Moffat
Alnwick
Rothbury
COQUET I.
NORTHUMBERLAND
Otterburn
Bellingham
Morpeth
Blyth
Langholm
Dumfries
Longtown
Newcastle
Tynemouth
South Shields
Sunderland
Gateshead
Hexham
Allendale
Carlisle
Wigton
Brampton
Durham
Seaham
Stanhope
Chester le Street
Hartlepool
CUMBERLAND
WESTMORELAND
Maryport
Workington
Cockermouth
Keswick
Whitehaven
St. Bees Hd.
Appleby
Barnard Castle
Darlington
Stockton
Middlesbrough
Redcar
Saltburn
Whitby
Robin Hood Bay
Richmond
Ambleside
Shap
Kendal
Aberdare
Merthyr Tydfil
Llandaff
Cowbridge
Cardiff
Newport
Chepstow
Usk
Tintern
Monmouth
Ross
Hereford
Leominster
Ludlow
Shrewsbury
Oswestry
Wrexham
Chester
Liverpool
Manchester
Bolton
Preston
Lancaster
Carnforth
Ulverston
Barrow
Whitehaven
Workington
Cockermouth
Keswick
Penrith
Wigton
Carlisle
Longtown
Dumfries
Stranraer
Port Patrick
Larne
Belfast
Belfast L.
Donaghadee
Strangford Lough
Pt. of Ayr
Milford Haven
Pembroke
Tenby
Carmarthen
Llanelly
Swansea
Burry
Gower
Worms Hd.
St. Govans Hd.
Caldy I.
Swansea Bay
Aberafon
Neath
Glamorgan
Severn R.
Severn Tunnel
Clevedon
Bristol
Bath
Bradford
Trowbridge
Frome
Wells
Shepton Mallet
Weston s. Mare
Axbridge
Cheddar
Ilfracombe
Linton
Watchet
Lundy I.
Barnstaple
Bideford
Hartland Pt.
Bridgwater
Taunton
Somerset
Exmoor
Wellington
Tiverton
S. Molton
Crediton
Honiton
Exeter
Devon
Dartmoor
Okehampton
Tavistock
Launceston
Tintagel Cas.
Bodmin
Padstow
Liskeard
Looe
Fowey
Truro
Falmouth
Penzance
St. Ives
Redruth
Camborne
Marazion
Helston
Lands End
Mounts B.
Falmouth B.
Lizard Pt.
Plymouth
Devonport
Plymouth Sound
Eddystone L. Ho.
Salcombe
Start Pt.
Totnes
Dartmouth
Brixham
Torquay
Tor Bay
Teignmouth
Dawlish
Ashburton
Newton Abbot
Moreton
Sidmouth
Axmouth
Lyme Regis
Beaminster
Bridport
Dorchester
Dorset
Weymouth
Portland I.
Portland Bill
Chesil Bank
Abbotsbury
Sherborne
Yeovil
Crewkerne
Ilminster
Shaftesbury
Blandford
Wimborne
Christchurch
Bournemouth
Poole
New Forest
Lymington
Southampton
Salisbury
Salisbury Plain
Stonehenge
Andover
Wilton
Romsey
Hampshire
Winchester
Petersfield
Alton
Farnham
Basingstoke
Whitchurch
Overton
Newbury
Reading
Wokingham
Windsor
Eton
Staines
Uxbridge
Middlesex
London
Hounslow
Kingston
Richmond
Greenwich
Woolwich
Barking
Romford
Southend
Brentwood
Foulness
River Thames
Sheerness
Sheppey I.
Gravesend
Rochester
Chatham
Canterbury
Herne Bay
Margate
North Foreland
Ramsgate
Sandwich
Deal
Goodwin Sands
Dover
S. Foreland
Folkestone
Hythe
Ashford
Maidstone
Kent
Tunbridge Wells
Tonbridge
Sevenoaks
Epsom
Croydon
Chertsey
Guildford
Godalming
Reigate
Dorking
Surrey
Horsham
Petworth
Midhurst
Arundel
Chichester
Havant
Portsmouth
Isle of Wight
Cowes
Ryde
Newport
Sussex
Lewes
Battle
Hastings
St. Leonards
Eastbourne
Beachy Head
Pevensey
Hailsham
Rye
New Romney
Dungeness
Hythe
Folkestone
Dover
Calais
Boulogne
Somme R.
Dieppe
Brighton
Worthing
Shoreham
Littlehampton
Selsea Bill
Needles
Freshwater
Ventnor
Cowes
Portsmouth
Southampton
Longitude West
from Greenwich
East

Carlyle, Macaulay, Hazlitt, M. Arnold, and Lang are conspicuous; as philosophers, Sir W. Hamilton and J. S. Mill; as theologians or preachers, Newman, Robertson, Maurice, and Liddon; as scientists, Darwin, Huxley, and Tyndall.

In the present work every author of note is mentioned under his or her name. See also AMERICAN LITERATURE.

English Music. Historians of music in Great Britain have established a notable position for the art in what must be called its infancy; and though the monuments on which they rely are not numerous, they are striking and significant enough to indicate that the ardent love for music which survives among the Welsh was once shared by all the people of England. Tradition credits King Alfred, in the 9th century, with the founding of a chair of music at Oxford. The discovery of a manuscript copied by John of Fornsete, a Reading monk of the 13th century, containing a *rota*, or round in six real parts, beginning, "Sumer is icumen in," gives the English priority long conceded to the Netherlanders in the invention of COUNTERPOINT (q.v.). The Cambridge Roll, preserved in Trinity College, supposed to be the work of John of Dunstable (d. 1453), contains a song of thanksgiving for the victory won at Agincourt 1415. The pre-eminence of certain composers in the subsequent centuries has led to the assignment to each of the headship of a school of composition, whether there was anything distinctive in their work or not. A few of their names may serve as milestones. They are R. Fayrfax, Doctor of Music 1511; J. Redford (1491–1547); Dr. C. Tye, Farrant, Bull, Tallis, Byrd, and Gibbons, who mark the high tide of the contrapuntal art in England as exemplified in church music and madrigals. The Rebellion checked musical development; but it began with renewed energy after the Restoration, one of the first

Minstrels from the Roman de la Rose, ab. 1480.

fruits being the establishment of the Chapel Royal under Cooke (d. 1672), M. Lock (d. 1677), H. Lawes (1595–1662), and others. From the Chapel Royal pupils have continued to go out, bringing honor to English music down to the present time. The greatest of these is also the greatest of England's native musicians, Henry Purcell. Others, as P. Humfrey, J. Blow, J. Clark (d. 1707), and W. Croft (1677–1727), stamped a character upon the English anthem that it has preserved ever since. The 18th century is chiefly remarkable for activity in the line of operatic composition (see ENGLISH OPERA), and the cultivation of the glee, in which Battishill (1738–1801), Cooke (1734–1793), and the first Earl of Mornington (1735–1781), were distinguished, and later Webbe (1740–1816), Stevens (1757–1837), Callcott (1766–1821), Attwood (1767–1830), Spofforth (1768–1827), and Sir H. R. Bishop. After Purcell's the name that stands highest on the roll of native English composers is that of Sterndale Bennett, who cultivated instrumental composition and also the oratorio, a form much admired since its institution by Handel and its enthusiastic cultivation at the MUSIC FESTIVALS (q.v.). In this department among later composers are Sir F. Ouseley (b. 1825), John Stainer, C. V. Stanford, A. C. Mackenzie, M. Costa, F. H. Cowen, and Sir A. S. Sullivan.

English Opera. What was called opera flourished in England to some extent soon after the invention of the LYRIC DRAMA (q.v.) by the Florentines. The introduction of music into stage plays was everywhere natural and easy in Europe where the earlier mystery plays were known. The bond between the play and the music was loose in England, and never became so closely knit as in Italian opera. Masks and other entertainments with incidental music were cultivated ab. 1650. In *The Siege of Rhodes*, 1654, instead of spoken dialogue recitative was used, and with the reopening of the theaters at the Restoration the love for opera grew. Purcell produced his *Dido and Æneas* 1675. In this also recitative was used, but soon after the conventional English form, with spoken dialogue and music introduced only in the form of songs, became fixed. The 18th century and first quarter of the 19th were prolific in these and ballad operas, the principal composers being Storace (1763–1796), Reeve (1757–1815), Hook (1746–1827), W. Shield (1748–1829), Dibdin (1745–1814), Kelly (1764–1826), Braham (1774–1856), and Bishop (1786–1855). The operas of these men, particularly the ballad operas, formed all the lyrico-dramatic entertainment which America enjoyed from 1750 to 1825. In the works of Balfe, Barnett, Benedict, and Wallace, the music still consists of independent pieces wrought into the plays, but a nearer approach to the lyric drama is made in the later works of Stanford, G. Thomas, and Mackenzie.

English Pale. Limits within which English conquerors of Ireland held dominion after the invasion of 1172. It embraces the districts of Drogheda, Dublin, Wexford, Waterford, and Cork.

English School of Painting. See REYNOLDS, GAINSBOROUGH, ROMNEY, LAWRENCE, WILSON, CONSTABLE, TURNER, WILKIE, LANDSEER, ALMA TADEMA, LEIGHTON, WATTS, and RIVIERE.

English Shire. See HORSE.

Engraving. See STIPPLE ENGRAVING, STEEL ENGRAVING, and WOOD ENGRAVING.

Engstrom, JOHAN, 1794–1870. Swedish novelist and poet.

Enharmonic Intervals IN MUSIC. Composed of tones which, though mathematically different and differently noted, are in effect the same, as C-sharp, D-flat. See GREEK MUSIC.

Enhydris. See MUSTELIDÆ.

Enigma. Puzzles, riddles, or dark sayings; much valued in ancient times.

Enkhuizen. Town of N. Holland, on the Zuider Zee; founded ab. 1200; once populous and of commercial importance; first to rise against Philip II. of Spain, 1572; birthplace of the artist Paul Potter. Pop. ab. 6,000.

Enlistment. Act of entering the military service. In the U. S. Army any male above 16 and under 35, able-bodied, free from disease, of good character, temperate habits, and having a competent knowledge of English, may be enlisted for three years. Restrictions exist in the case of minors.

Enneandria. Linnæan class of plants, including those with nine stamens; *e.g.*, the Laurel, Sassafras, and Rhubarb.

Ennemoser, JOSEPH, 1787–1854. Tyrolese physician, prof. Bonn 1819–37. *History of Magic*, 1842, tr. 1854.

Enniskillen, WILLIAM WILLOUGHBY COLE, LL.D., D.C.L., F.R.S., EARL OF, 1807–1886. Irish peer, devoted to the study of fossil fish; his valuable collection is now in the British Museum.

Ennius, QUINTUS, 239–169 B.C. Latin poet, b. in Calabria: resident in Rome from ab. 203 B.C.; author of tragedies, comedies, epics, and satires. His *Annales*, in 18 books, gave the history of Rome in hexameter verse. Though only fragments remain, we know, from them and from statements of ancient authors, that he exerted great influence on the development of Roman literature, then in its infancy, and introduced the more perfect forms of composition practiced among the Greeks.

Ennodius, MAGNUS FELIX, 474–521. Bp. of Pavia; writer in Latin prose and verse.

Enoch. 7th from Adam; father of Methuselah; translated.

Enoch, BOOK OF. Of unknown date and authorship, probably 1st century B.C.; long lost; recovered 1773 in an Ethiopic version; tr. 1821.

Enopla. See NEMERTEA.

Enriquez, ANTONIO GOMEZ. Spanish dramatist and poet, fl. 1656. His father was a Portuguese Jew, and in later life he returned to his ancestral faith in Holland, and was burned in effigy at Seville 1660.

Ensheim, or ENSISHEIM. In e. France. Here Turenne defeated the imperial army, and drove it from Alsace, Oct. 4, 1674.

Ensiform. Cartilage at posterior end of sternum.—In Botany, sword-shaped leaves.

Ensign. Flag at stern of a ship.—Lowest commissioned officer of British infantry till 1871. Lowest commissioned officer in U. S. Navy since 1862.

Ensilage. Process for the preservation of fodders in the green state; invented by Auguste Goffart; introduced into the U. S. ab. 1876, and since extensively used. Its successful practice demands that the building or silo shall be air-tight and sufficiently protected from the weather, and the material placed in it while still green, allowed to heat till the greater number of the germs of fermentation are killed (*i.e.*, to ab. 120° F.), and then carefully sealed from the air. Indian corn is the crop most often preserved in this way, though clover and green rye are often used, and any green crop may be successfully treated.

Enstatite. $MgSiO_3$. Highly refractory magnesium silicate, orthorhombic in crystallization, closely resembling pyroxene in many of its properties.

Entablature. In Classic Architecture, the horizontal structure carried upon the columns and with them forming the order. It consists of three members, originally and properly distinct courses of stone, the architrave, frieze and cornice. The proportions and details of these vary greatly in different orders, and to a less degree in different examples of the same order.

Entail. Estate in fee limited to a particular class of heirs, as those of a man's body: generally abolished in U. S., and greatly modified in Gt. Britain. It is generally intended to keep family lands undivided; consistently opposed by economists.

Entanglement. Obstruction consisting of telegraph wire fastened to stakes or to the stumps of trees, designed to break the formation of troops in their advance upon a position; usually arranged at a height so as to trip up the troops when they are rapidly advancing. It may also be contrived by slashing trees and allowing them to fall so as to interlock their branches.

Entasis. The outward curve given by the architects of the Grecian Doric to the shafts of columns to increase the appearance of stability.

Entelechy. Aristotle's technical name for the soul and the principle of life.

Entellus. See SEMNOPITHECIDÆ.

Entente Cordiale. Name given to the cordial relations which existed between the English and French governments under Louis Philippe, and subsequently to all friendly understandings between two nations.

Enteralgia. Neuralgia of the intestines.

Enteric Fever. See TYPHOID FEVER.

Enteric Pouches. Diverticula of the primitive digestive cavity or enteron, supposed to give origin to the body cavity in the *Cœlomata*.

Enteritis. Inflammation of the bowels, particularly of the small intestine.

Enterocœl. Body cavity (cœlom) formed by pouches from the primitive digestive cavity (archenteron).

Enterocœla. In a broad sense, all animals possessing an enterocœl. As a sub-group of *Vermes*, it includes *Enteropneusta* and *Chætognatha*.

Enteron. Digestive cavity of animals.

Enteropneusta. Group of animals which includes *Balanoglossus*.

Enthymeme. Syllogism in which one premise is implied, not expressed.

Entirety. Common law estate in land held by husband and wife under a conveyance of the fee to both. Neither can dispose of his or her interest without the other's assent, and the whole goes to the survivor.

Entity. Reality or substance; ground or permanent basis of phenomena.

Entolithia. See RADIOLARIA.

Entomology. Science which treats of Insects in their zoölogical relations either to Man or to one another.

Entomophaga. Tribe of *Terebrantia* having stalked abdomen and freely projecting, lengthy ovipositor. The larvæ are footless and aproctous, and live generally as parasites in the larvæ of other insects; as they adapt themselves to the complicated life-changes of their hosts, their metamorphoses are remarkable. The *Ichneumonidæ* are included in this group. See VERMILINGUIA (*Edentata*).

Entomophaga (INSECT-EATING MARSUPIALS). Group of *Polyprotodontia*, including the Opossums and Bandicoots. The former are American, are climbers (hence *Scansoria*), have the inner toe of the hind foot opposable (hence *Pedimana*), have prehensile tails, and constitute the family *Didelphidæ*. The Bandicoots are Australian, insectivorous forms, with pointed snouts, with hind legs developed for jumping (hence *Saltatoria*), and constitute the family *Peramelidæ*. They mimic the *Insectivora* of the rest of the world in habits and some points of structure.

Long-nosed Bandicoot (*Perameles nasuta*).

Entomophilous. Flowers cross-fertilized by insects, which transport the pollen from the anthers of one to the pistils of another.

Entomophthoraceæ. Order of Fungi of the sub-class *Phycomycetes*, parasitic on insects.

Entomostraca, or GNATHOPODA. Small soft-shelled *Crustacea*. The group includes the orders: *Phyllopoda*, *Ostracoda*, *Copepoda* and *Cirripedia*. The first three are collectively termed the *Lophyropoda*.

Entoparasite. Parasite living within the body of a plant or animal.

Entophyte. Vegetable parasite within the body.

Entoplastic Tissues. Those formed by a metamorphosis of the protoplasm of the cells of the blastema; opposed to Ectoplastic.

Entoptic Sensations. Visual sensations due to stimuli intrinsic to the structure of the eye. Perhaps the most striking of these phenomena are the so-called *muscæ volitantes*, which are small particles, granules, fibers, etc., floating in the vitreous humor of the eye and appearing in the visual field as small moving dark spots and lines. They are best seen by looking intently at some bright, blank surface, such as the sky.

Entozoa. In a broad sense, all animals parasitic within the bodies of others; in a restricted sense, parasitic *Platyhelminths* and *Nemathelminths*.

Entr'acte. Intermission between acts of a play.

Entrecasteaux, JOSEPH ANTOINE BRUNI D', 1739–1793. French seaman, commanding in E. Indies 1785.

Entrenchment, or INTRENCHMENT. To artificially strengthen a position occupied by troops earthen works are usually constructed to prevent the position from being carried by a sudden onslaught of the enemy. These works are of various degrees of defensive value. When thrown up by troops themselves on arrival, they consist of the barest cover from musketry fire; when carefully designed and constructed to get all the possible passive defensive value by art of military engineering, the position is said to be intrenched.

a, Entresol.

Entrepreneur. One who borrows capital and hires laborers, paying for each of them the usual rate, using them in business production, and retaining the profits of the investment for himself as his earnings. The function is generally fulfilled by the employing class.

Entresol. French name for a mezzanine or low story between two higher stories, usually formed by inserting a floor at the line of springing a series of arches.

Entropion, or ENTROPIUM. Rolling inward of the border of a tissue, as of the margin of an eyelid.

Entropy. With Clausius, unavailable energy, as in the statement, "the entropy of the universe tends to a maximum;" with Thomson and Tait, the available energy of the universe. They have modified Clausius' statement thus: "the entropy of the universe tends to zero." Mathematically stated, $de = \frac{dH}{\theta}$; in which e represents entropy, H heat, and θ temperature.

Entry. 1. Going upon real property; it may be an element in burglary, a trespass, or rightful. 2. Taking possession of realty: at common law this might be done by rightful owner with force and arms, but the forcible recovery of possession is now to be sought by judicial proceeding.

Entry. Main haulage gangway in bituminous coal mines of Pa.

Enuresis. Involuntary urination.

Envelope. Line formed by points of intersection when a curve changes regularly in position or elements, so as to form a series of intersecting curves.

Environment. The aggregate of surrounding things or conditions of an animal or plant. The agencies and influences which affect an organism from without.

Envoy. Diplomatic agent next in rank to the ambassador, styled envoy extraordinary and minister plenipotentiary. A special agent charged with a particular mission is also called an envoy.

Enzina. See ENCINA.

Enzio, 1225–1272. Precocious German warrior, sent to Italy 1239 by his father, Frederic II., as Vicar Imperial. He won many victories, especially over the Genoese 1241, but in a later expedition was less successful, and was in prison from 1249.

Enzymes. Ferments produced within the body, as those concerned in digestion.

Eobanus, HELIUS (KOCH), 1488–1540. Humanist, prof. Erfurt 1517 and Marburg 1536; called "the Hessian David" from his Latin version of the Psalms, 1537.

Eocene. Lower Tertiary bed; term introduced by Lyell. Its significance is that the existing testaceous fauna of the earth then began to appear. It is the dawning time of recent species. The Eocene in Europe is found chiefly in the London and Paris basins and in the Netherlands. In N. America Eocene formations occur on the Atlantic Coast and in the Mississippi Valley. Eocene strata, rich in fossils and many thousand feet thick, the filling of extinct lakes, occur between the Rocky Mts. and the Wahsatch, on both sides of the Uintah range. The Eocene yields, at present, the oldest Mammalian fossils above the grade of Marsupials.

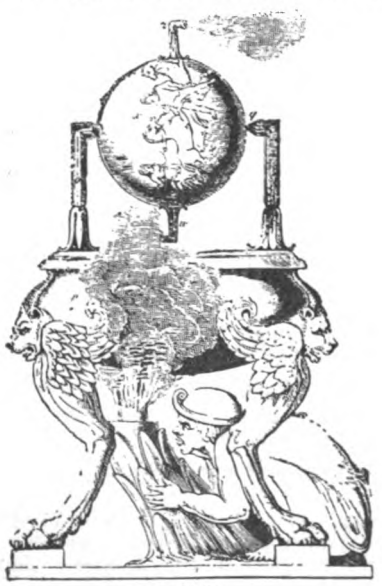
Eohippus. Lower Eocene American ungulate of the size of a fox, having three-toed hind feet, fore-feet with four toes, and a rudimentary fifth, and teeth slightly resembling those of a horse, of which it is probably an ancestor. See EQUIDÆ.

Eolian, or ÆOLIAN. Strata supposed to have been accumulated by the wind, or the action of the wind in wearing down or removing materials. Wind action is exceedingly common and often violent in deserts and on sea beaches, where its results in scratching and smoothing rock surfaces and raising sand-dunes are as conspicuous and important as are those of water in other places.

Eolian Harp. See ÆOLIAN HARP.

Eolidæ. See NUDIBRANCHIATA.

Eolipile. Contrivance of Hero of Alexandria ab. 120 B.C.; probably the first application of steam power for the production of motion. It consists of a hollow metal sphere capable of rotation about an axis. It is fitted with two small tubes, bent at right angles and facing opposite ways, through which steam may be made to issue by boiling water in the vessel by means of a spirit lamp. The reaction of the steam as it issues from the pipes causes the sphere to rotate in a direction opposite to that of the issuing steam.



Eolipile.

Eon de Beaumont, called CHEVALIER D'EON, 1728–1810. French diplomatist and writer; at the Russian court 1755, at the English 1762; falsely reported to be a female, he was required to wear the female dress after 1777; in England from 1784.

Eon, or **Eudo, de Stella,** b. ab. 1100. French enthusiast, who fancied himself the Judge of all; locked up as insane 1148. Some of his disciples (perhaps a Catharian sect) were burned.

Eopteris. Impression resembling that of a fern, from the Silurian strata in France; described by Saporta as *Eopteris morieri;* probably not organic.

Eos. See AURORA.

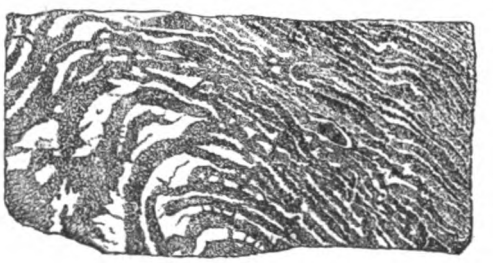
Eoscorpius. Fossil scorpion found in the Carboniferous of Scotland and America, and recently in Upper Silurian strata in both continents.

Eosin. $C_{20}H_8O_5Br_4Na_2$. Sodium or potassium salt of tetrabrom fluorescein; produced by the action of bromine on fluorescein; red crystals or powder, soluble in water. It dyes animal fibers red in an acid bath. See FLUORESCEIN.

Eötvös, JOSEF VON, 1813–1871. Hungarian dramatist and novelist; Minister of State 1848 and 1867. *The Carthusians,* 1838; *Village Notary,* 1846, tr. 1850.

Eozoic. Strata older than the Cambrian; supposed to contain the earliest traces of life; word introduced chiefly to describe the Laurentian strata, in which Eozoön was found. If that should prove to be inorganic, this adjective will for a time at least, cease to have any significance.

Eozoön. Structure found in Middle Laurentian limestone rocks; considered by some the remains of a foraminiferous animal somewhat resembling a gigantic shell-clad amœba. The assertion of its organic nature, maintained by Sir J. W. Dawson, Dr. T. Sterry Hunt, and Dr. W. B. Carpenter, has been repeatedly impugned by many other naturalists, and the right of Eozoön to a place in the animal kingdom is exceedingly doubtful. Dr. Johnstone Lavis even claims that he has found similar structure in the Vesuvian lavas.



Fragment of *Eozoön*, five-sixths natural size, showing alternate laminæ of loganite and dolomite.

Epacme. Life of an animal from birth to full maturity.

Epacridaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledons*, and series *Gamopetalæ*, comprising 26 genera and ab. 325 species, growing in greatest numbers in Australia; some are found in the Indian Archipelago.

Epact. Number depending on the relations between the motions of the Earth and Moon; used in computing the ecclesiastical calendar.

Epaminondas, 362 B.C. Theban statesman and general who gained a great victory over the Spartans at Leuctra 371 B.C.; 4 times invaded Peloponnesus, and was killed at Mantinea. The supremacy of Thebes began and ended with him.

Epanody. Reversion of irregular flowers or other organs to a regular structure or condition.

Epaulement. That portion of the parapet of a battery, screen or cover which protects the flanks from a flank fire of the enemy.

Epaulet. Shoulder-knot worn in the U. S. A. by generals, in British army by officers and men till 1855, in British navy since 1795, and in other armies and navies.

Epée, CHARLES MICHAEL, ABBE DE L', 1712–1789. Jansenist

preacher who was deprived of his cure and interested himself in the education of deaf-mutes, and founded an institution at his own expense ab. 1770.

Epenchyma. Tissue of the cambium layer in woody plants.

Epernay. French town on the Marne ab. 20 m. from Chalons, the center of the Champagne district. Pop., 1891, 18,252.

Ephah. Jewish measure of capacity containing 6⅔ gallons.

Ephelis. See FRECKLES.

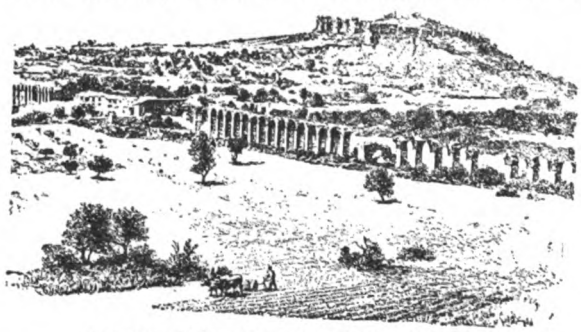
Ephemeral. See FUGACIOUS.

Ephemeridæ (MAY-FLIES). Tribe *Amphibiotica* of the group *Pseudoneuroptera*. They have a slender, soft-skinned body, short antennæ, front wings large, the hinder often rudimentary. The mouth parts are also rudimentary. The abdomen ends in two or three long filaments; the male has also a pair of jointed copulatory forceps and long front legs. These flies live only a short time in the winged or mature state, and take no food, devoting themselves entirely to reproduction. The larva lives at the bottom of clear waters, has a large square head, and gills on the abdomen. Some require 3 years to become mature.

Ephemeris. Table giving the position of a heavenly body from day to day. Thus the Solar Ephemeris gives the position of the sun for every day throughout the year.

Ephesians, EPISTLE TO. 10th N. T. book, written by St. Paul from his prison at Rome, ab. 62.

Ephesus. In Lydia, on the Cayster; chief of the 12 Ionian cities in Asia Minor; famed for the temple of DIANA (q.v.); capital of the Roman province of Asia; long the residence of St.



Ephesus—Ruins of the Aqueduct and Citadel.

John; sacked by Goths 262. Explorations 1863–74 resulted in important discoveries, including the foundations of the ancient temple.

Ephesus, COUNCILS OF. 1, ab. 196. 2, ab. 245. 3, 400. 4, 3d general, and 5, both 431; Nestorius and Cyril deposed. 6, ab. 445. 7, 449, "Robber Synod"; held to proclaim Monophysite doctrine and restore Eutyches. 8, 476.

Ephesus, SEVEN SLEEPERS OF. Legend of Christian refugees from Decian persecution, 250, who slumbered in a cave near the city till 437; finely rendered in a poem by Dr. J. M. Neale, 1866.

Ephialtes. In Greek Mythology, a giant who, warring against the gods, lost the left eye by Apollo and the right by Heracles.

Ephidrosis. Excessive sweating.

Ephippium. 1. Extra shell, secreted by the brood-pouch about the "winter eggs" in minute *Crustacea, e.g., Cladocera*, for their protection. 2. Pouch in the back of *Daphnia* into which the eggs pass.

Ephod. Robe of Jewish priests; especially decorated for the High-Priest.

Ephori. Principal elective magistrates in many Dorian cities of Greece, especially at Sparta, where they numbered five and exerted a controlling power even over the kings, until Cleomenes massacred those then serving and abolished the office 226 B.C.

Ephorus, 4th century B.C. Greek of Cyme in Asia; author of a history in 30 books, extending to 340 B.C.

Ephraim. Son of Joseph, progenitor of the tribe whose jealousy of Judah led to the secession of the Ten Tribes under Rehoboam.

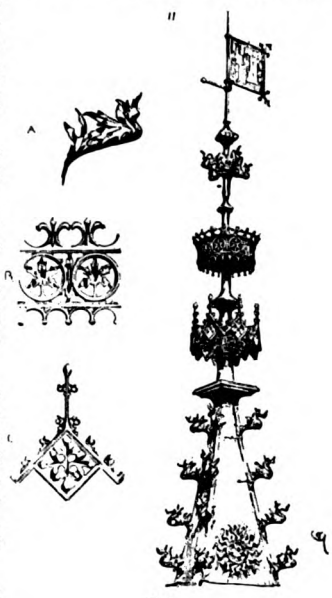
Ephrem Syrus, ab. 307–373. Poet and theologian; hermit at Edessa from 363. He wrote extensively in Syriac against the Gnostic heresies; many of his works exist in Greek versions. *Hymns and Homilies*, tr. 1853. His day in the Eastern Ch. is Jan. 28, in the R. C., Feb. 1.

Ephyra. Larva of a *Scyphomedusa* as set free from the strobilated *Scyphistoma*. It is a flat disk with 16 marginal lobes, in 8 pairs.

Ephyra-Medusæ. See DISCOPHORA.

Ephyridæ. Family of *Cannostomæ* having broad, simple radial pockets without branches and no ring canal. The jellyfish *Nausithoe* is an example.

Epi, or GIROUETTE. Ornament on the summit of a gable; a vane, weathercock, or the general ornamental ironwork surmounting the cones of pavilions or pointed roofs of Renaissance architecture. Many of the epis in France and Belgium are very elaborate.



Epi.

Epiblast. Outer layer of cells of the early embryo or blastoderm. In Agrostology, appendage opposite the scutellum in seeds of grasses. See ECTODERM.

Epiblema. System of thin-walled epidermal cells and trichomes, constituting the absorbing apparatus of roots.

Epibole, or EPIBOLIC GASTRULATION. Formation of the gastrula stage in eggs that have much food yolk, by the spreading of the blastoderm over the surface of the egg until the yolk is entirely inclosed. The point of closure is the blastopore.

Epic. Imaginary narrative in verse; the most extensive and ambitious kind of poetry, as opposed to the lyric and other minor varieties. Among the chief examples are the *Iliad* and *Odyssey*, the *Mahabharata* of India, Virgil's *Æneid*, Dante's *Divina Commedia*, Camoens' *Lusiad*, Tasso's *Jerusalem Delivered*, Spenser's *Faery Queen*, Milton's *Paradise Lost*, and Byron's *Childe Harold*. Scott's longer poems and Tennyson's *Idylls* are minor epics; Butler's *Hudibras* is a burlesque epic. The epic proper belongs to the past, and is seldom attempted in our time.

Epicalyx. Whorl of bracts immediately behind the calyx of a flower.

Epicarp. External layer of the pericarp or seed-vessel when it is very thin and membranaceous.

Epiceratohyal. Bone in the hyoid arch above the ceratohyal, and corresponding to the epibranchials of the other arches.

Epicharmus, ab. 540–450 B.C. Greek author, chiefly of comedies. He lived at Syracuse, and was praised by Plato. Only fragments survive.

Epichilum. Upper portion of the labellum in orchids.

Epichlorhydrin. $CH_2Cl.O.CH.CH_2$. Liquid boiling at 117° C., and produced from glycerine by the action of phosphorous pentachloride. It is insoluble in water, but unites with water when heated with it, forming chlorhydrin. It has an odor like that of chloroform, and a sweet, burning taste.

Epicoracoid. Supplementary cartilage attached to the anterior and mesial edge of the coracoid bone.

Epicoralline. Organs borne on the corolla.

Epicormic. Branches which rise from the side of a tree after other trees which have grown near it are cut down.

Epicotyl. Portion of a germinating stem above the cotyledons.

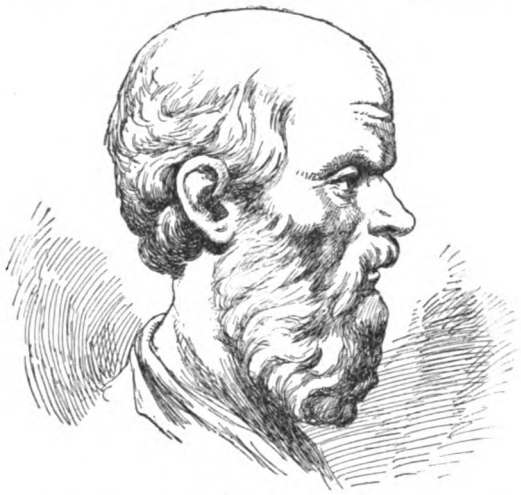
Epicranium. Part of the insect's head (the "forehead") between the eyes down as far as the clypeus or supra clypeus and back to the occiput. It has a suture along its middle formed by the union of the procephalic lobes. The ocelli are on pieces imbedded in it dorsally.

Epictetus, ab. 55–ab. 125. Stoic philosopher, b. in Phrygia;

in early life a slave and freedman at Rome; after 89 at Nicopolis in Epirus. His teachings, wholly ethical in scope, are pure, lofty, and inspiring; his character was genuine and noble; his life, as disclosed by tradition, was humble and consistent—"maimed in body, an Irus in poverty, and favored by the Immortals." His discourses were reported in Greek by his disciple Arrian, and tr. 1758 and 1865. After Marcus Aurelius, who revered his memory, he is the chief glory of the later Stoic school.

Epicureanism. System which regards pleasure as its end; understood less grossly by its founder than by many of his followers.

Epicurus, 341–270 B.C. Greek philosopher, at Athens from 306; celebrated for his development of the atomic doctrine and a system of ethics founded wholly on personal happiness. He was the first to give shape to scientific materialism by making mental action a function of an atomic organism. He maintained that the highest good is happiness, and that



Epicurus.

virtue is to be practiced as leading thereto. Happiness, in his view, was not sensual enjoyment, but the peace of mind which comes from cultivation of all the virtues. His system was greatly perverted by his followers.

Epicycle. See DEFERENT.

Epicycloid, or HYPERCYCLOID. The path of a point on the circumference of a circle rolling upon the convex arc of a fixed curve. The fixed curve is the directrix, the moving circle the generating circle, the tracing point the generatrix. This curve is much used for the profiles of the teeth of wheels outside the pitch line.

Epidamnus. See DYRRACHIUM.

Epidaurus. Town on e. coast of Argolis in the Peloponnesus; famed for a sanctuary of Æsculapius, in whose honor games were celebrated here every four years.

Epidemic. Diseases which attack many at the same time; they may be contagious, but are not necessarily so.

Epidermis (CUTICLE). In Botany, layer or layers of cells which cover nearly the entire surface of growing flowering plants, ferns, etc. See CUTICLE.

Epididymis. Flattened body at the side of the testicle, made up of a number of seminal ducts and a tube continuous with the *vas deferens*, which they unite to form. When inflamed the condition is known as Epididymitis or Swelled Testicle.

Epidote. Aluminium, iron, and calcium silicate, usually yellowish-green in color, sometimes handsomely crystallized, and frequently occurring as an important rock-forming mineral. It resembles some varieties of amphibole and pyroxene.

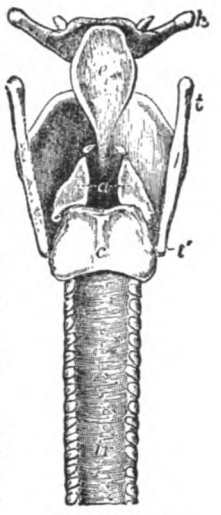
Epigæa. Genus of perennial suffruticose, trailing plants; leaves evergreen. *E. repens* is the well-known Trailing Arbutus or Mayflower.

Epigastric Vein. See ANTERIOR ABDOMINAL VEIN.

Epigastrium. Region overlying the stomach.

Epigenesis. Mode of creation or reproduction of individuals in which the germ in the egg develops from formless matter, as in *Archigonia*. This theory arose when the microscope first revealed the fact that the germ appears to be so developed, it having been previously believed that each organism existed in miniature in each egg and was simply expanded into the adult.—SYNGENESIS. This used to be called Evolution, but the "New Evolution" is a compromise between the old and the Epigenesis theory, and is based on the fact that in Ontogeny there is a successive differentiation, as well as growth of a preformed germ.

Epiglottis. Elongated leaf-shaped cartilage over the entrance to the larnyx, which prevents the entrance of food, etc., into it.



Epiglottis.

h, hyoid bone; *t*, the superior, and *t'*, the inferior cornu, of the thyroid cartilage, *c*, placed on the median ridge of the back of the cricoid cartilage, *a*, placed between the two arytenoid cartilages, to which the letter points by two dotted lines; the cartilages of Santorini or cornicula are shown above the upper angles; *t r*, the trachea; *e*, the epiglottis.

Epignathores. Birds having the upper mandible the longer.

Epigoni. Seven sons of the seven Argive chiefs who made war on Thebes after their fathers had failed; theme of Æschylus's play, *Seven Against Thebes.*

Epigonium. Product of the ripened archegonium in *Bryophytes.*

Epigram. With the Greeks, inscription (epigraph) on a tomb or monument; with Romans and moderns, a pointed and witty poem of 8 lines or less. French, German, and English literature affords many examples.

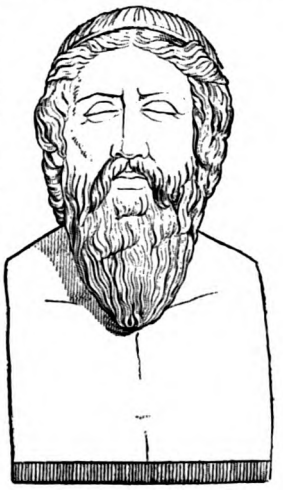
Epigraphy. Science of inscriptions, now a most important branch of philology.

Epigynum. Spermathecæ of a female spider. It is on the middle line of the abdomen, behind the last pair of legs, and between two stigmata.

Epilepsy. Disease of the nervous system occurring most often in the country and in temperate climates, coming on usually between ages of ten and twenty, and attacking both sexes alike, in which no changes are as a rule found after death except, rarely, induration of various parts of the nervous system; occasionally may be the result of injuries to the head. Family history of epilepsy, insanity, or other nervous disease exists in one-third of the cases; fright, irritation of the alimentary canal, eye or ear may be exciting causes in those predisposed to it; masturbation in either sex often accompanies it, although probably not an active element in its causation: 10 per cent of patients become insane, about the same number recover, and in long-standing cases life is rarely prolonged beyond 50. Essential element is sudden loss of consciousness, usually accompanied by convulsions of varying severity. Often pain in the head, vertigo, flashes of light, hallucinations of any of the senses, feelings of numbness or tingling in various parts of body precede an attack. When severe there is usually a spasm of the muscles followed by convulsions, this variety being termed grand mal; slight attacks, termed petit mal, are usually unattended with convulsions and may consist simply of a momentary loss of consciousness. Treatment consists almost exclusively in the use of the bromides; good food, etc., aid greatly; cases dependent upon injuries to the head are often cured by trephining.

Epilogue. Close of a discourse; more usually, address appended to a play.

Epimenides. Poet and priest of Crete, who, when a boy, is said to have fallen into a sleep which lasted 57 years. He visited Athens by request to purify the city ab. 596 B.C., and stayed a plague then raging. St. Paul has cited a verse of his, Titus i. 12.



Epimenides.

Epimeres. Successive joints of the arms of Crinoids, Vertebrate's limbs, Arthopodan appendages.

Epimerum. Upper of the two parts that form the pleuron or sides of the arthropodant segment (somite).

Epimetheus. Brother of Prometheus, husband of Pandora, and father of Pyrrha.

Epimyeteri. See FISSIPEDIA.

Epinay, MME. LOUISE FLORENCE PETRONILLE DE LA LIVE D', ab. 1725–1783. French author, friend and benefactor of Rousseau, who attacked her in his *Confessions.* Her *Conversations of Emilie,* 1774, was approved by the Academy. *Memoirs,* 1818.

Epinette. See SPINET.

Epiostracum. Outer layer of chitinous shell of *Crustacea.*

Epiotic. Bone formed in the auditory cartilage above the arch of the posterior semi-circular canal.

Epiphanius, 310–403. Bp. of Constantia or Salamis in Cyprus 367; violent writer against heresies. *Panarion.*

Epiphany. Ch. festival Jan. 6 in honor of Christ's manifestation to the Gentiles, in persons of the Magi.

Epipharynx. Median projection on the internal surface of the upper lip of insects.

Epiphlœum. Outer layer of the bark of an exogenous stem; corky layer, very conspicuous in the Cork Oak, from

Gathering the Bark of the Cork Tree.

which the cork of commerce is derived, and in the corky winged branches of the Sweet Gum,

Epiphora. Condition in which the tears run over the lower eye-lid.

Epiphragm. In Mycology, membrane which temporarily covers the sporophore in certain *Gasteromycetes;* in Bryology, membrane which covers the mouth of the sporange in certain mosses.

Epiphysial Eye. Relic of a medial eye in Vertebrates; seen in Lizards; lodged in the parietal foramen, and connected with the pineal gland, of which it forms a part.

Epiphysis. Portion of a bone which develops separately but afterward is joined to it.

Epiphytes. Plants growing without connection with the soil, generally resting on the stems or branches of other plants, but without drawing nutriment from them. This they are able to obtain from the air above, and are hence called Air-plants; *e.g.,* the Long Moss of the Southern States and many tropical orchids.

Epiphytotic. Wide-spread disease or epidemic among plants.

Epiplasm. That portion of the protoplasm which remains in the ascus of the ascomycetous *Fungi* after the spores have been separated out; called also Glycogen.

Epipodia. Lobes developed on the "foot" of pteropod mollusks.

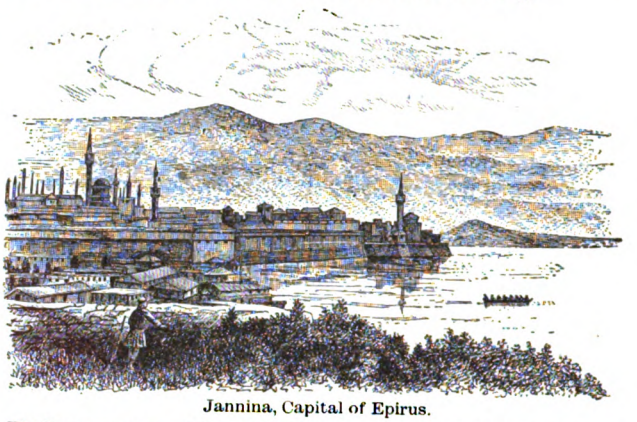
Epipodialia. Second element of the limb of a vertebrated animal; viz., the radius and ulna of the anterior, and the tibia and fibula of the posterior extremity.

Epipodite. Extra process (besides the exopodite and endopodite) borne by the protopodite of some of the appendages of Crabs, Lobsters, etc. On the legs these are the flabella or "gill-carriers."

Epipterygoid. Cartilage, or cartilage-bone, lying upon the splint-bone, the pterygoid in Lizards and Turtles.

Epipubis, or YPSILOID CARTILAGE. Y-shaped cartilage in front of the pubis in some *Amphibia;* analogous to the "marsupial bones" of the opossum among mammals.

Epirus. Country in n.w. Greece, inhabited by 14 different tribes. It contained the ancient oracle of Dodona. Pyrrhus, who invaded Italy 280 B.C., was its most noted king.



Jannina, Capital of Epirus.

Episcopacy. Form of Ch. government believed by many to have existed from the Apostles, by others to have grown from a previous congregational or presbyterial system; prevalent early in 2d century and after, among sects as well as in the Catholic Ch.; abandoned by most Protestant bodies after the Reformation, but still maintained by ab. 90 per cent of professed Christians throughout the world.

Episcopal Church, PROTESTANT. American branch of Anglicanism, organized 1789; governed by triennial General Convention of House of Bishops and House of Deputies. Dioceses and Missionary Jurisdictions 67, bishops 76, clergy ab. 4,300, parishes and missions ab. 6,000, communicants ab. 450,000.

Episcopal Church, REFORMED. See REFORMED EPISCOPAL.

Episcopius, or **Biscop,** SIMON, 1583–1643. Dutch theologian, prof. at Leyden 1612; banished as an Arminian 1618–26; prof. in Remonstrant Sem. at Amsterdam 1634. *Confession,* 1622.

Episkeletal Muscles. Those above the endoskeletal system. Most muscles are of this class.

Episperm. Outer seed-coat or testa; also known as Spermoderm.

Episporangium. See INDUSIUM.

Epistaxis. Nose-bleed.

Epistemology. Science of the process and nature of knowledge. Its position is intermediate between psychology and metaphysics.

Episternum. More ventral of the two parts which make up the pleura or sides of the arthropod segment.

Epistles. 21 N. T. books, apostolic letters to churches or individuals; viz., 14 of St. Paul, 1 of James, 2 of Peter, 3 of John, and 1 of Jude. Important uncanonical epistles are those of Clement, Barnabas, Ignatius, and Polycarp.

Epistolæ Obscurorum Virorum. Letters pub. 1515–17 in corrupt Latin, satirizing monks and schoolmen; called forth by the persecution of Reuchlin; probably by Rubianus and Von Hutten. They exerted great influence, and helped the Reformation.

Epistoma. Oval shield of crabs; space in front of (above) the mouth.

Epistome. Tongue-shaped process above the mouth in phylactolæmatous *Bryozoa.*

Epistrophe. Position of chlorophyll grains lying with their longer axes parallel with the surface of the organ in which they are contained, and thus along the upper or lower cell-walls.

Epistropheus. Axis, or 2d vertebra, bearing the odontoid process.

Epistylium. In Architecture, properly the entablature, but in practice usually applied only to its lowest member, the architrave.

Epitaph. Inscription in prose or verse, engraved on a tomb or composed for that use, setting forth the deeds or virtues of the deceased. They have existed in every age and of every quality: many are terse and eloquent.

Epithalamium. Bridal hymn, sung anciently in honor of the newly married; common among Greeks and Romans. A notable modern example is by Spenser.

Epitheca. Layer of coral cementing the thecæ externally.

Epithelioma. Variety of cancer in which epithelial cells predominate. It originates upon mucous or cutaneous surfaces.

Epithelium. Layer of cells which forms the epidermis of the surface of the body, the mucous membranes continuous with the skin, and parts of the organs of the special senses.

Epithelium.

Stratified pavement epithelium investing a simple papilla (with blood-vessels in the interior) from the gums of a child. Mag. 250 diam.

Epithet. Adjective; word or words qualifying a noun.

Epitome. Summary, abridgment, or abstract; useful as an aid to students, and chiefly in case of works which have perished.

Epitrochoid. Curve traced by a point attached to a circle (but not on its circumference) when the latter rolls on the circumference of a second circle. These curves are of no industrial application, but can be made of use in decorative patterns.

Epixylous. Fungi growing on wood.

Epizoa. Group of *Crustacea*, including *Ichthyophthira*, *Rhizocephala*, and *Cirripedia;* animal parasites, whose habitat is the exterior of the host.

Epizoötic. Disease affecting many animals at the same time, and often contagious, usually a febrile condition with cough, running from the nose, bronchitis, and great loss of strength, attacking horses.

E Pluribus Unum. (One Out of Many.) Motto of the U. S.; thought to have been derived from a verse (103) in the pseudo-Virgilian *Moretum: Color est e pluribus unus.*

Epoch. Subdivision of geologic time, as the Quaternary Epoch; properly, point of time, not a period; commencement or close of an era.

Epoch. When a vibrating body is at the extremity of its path on the positive side, it is said to be in the position of maximum positive elongation; and when at the opposite end, in that of maximum negative elongation. Time may be reckoned from the former of these points or from some other point. In the latter case, the interval of time estimated from this point of reckoning until the vibrating body next comes to its position of maximum positive elongation is called the Epoch.

Epode. Last part of a Greek chorus; lyric with short and long lines alternating.

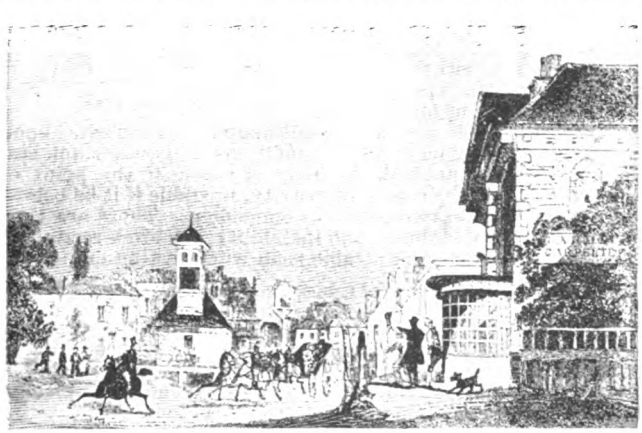
Eponym. Mythical ancestor of a tribe, as Tros or Italus.

Epo-ophoron. Parovarium, or Rosenmuller's organ; relics of Wolffian or Malpighian tubules, posterior to the hydatids of the ovary; homologue of the vasa efferentia of the male.

Epping Forest. Royal forest in s.w. Essex, Eng., formerly called Waltham Forest; once contained 60,000 acres; reduced to 12,000 in 1793; now contains 5,600; opened to the public May 1882.

Eprouvette. Instrument for testing the strength of gunpowder by measuring the force of the recoil.

Epsom. Small town 15 m. s.w. of London, England. It was formerly famous for its mineral springs from which Epsom Salts were made and was a fashionable resort. On the Downs near by horse races have been held since the time of Charles I. The famous Derby Stakes were instituted here by the Earl of Derby 1780.



Epsom, Surrey.

Epsom Salt. $MgSo_4+7aq$. Hydrous magnesium sulphate, usually prepared artificially, but also occurring in nature in the waters of mineral springs, and in delicate efflorescences on rock surfaces, or on the floors of caverns, mingled with earthy accumulations. It is widely used as a cathartic. See Magnesium Sulphate.

Epulis. Tumor growing from the jaw near the root of a tooth; usually fibrous and elastic.

Epworth League. Organized 1889 at Cleveland, O.; named from John Wesley's birthplace in Lincolnshire. It has a large membership among Methodists, and aims to benefit the young.

Equal. In Geometry, magnitudes are equal when being superposed they coincide throughout.—In Algebra, quantities are equal when they contain a common measure the same number of times.

Equality of Happiness. Ideal that each person should have an equal share of happiness (so far as this depends on the action of others), considered as an ethical or political end.

Equality, Symbol of. Two horizontal parallel lines between the expressions involved.

Equal Roots. An equation of any degree in one unknown has equal roots when two or more of the factors into which the function may be resolved are identical. Equal roots are determined from the greatest common divisor of the given function and its first derivative. The roots of the equation formed by equating the G. C. D. with zero will each be found as a root of the original equation once more than in the G. C. D. equation. If the latter has roots 2 and 3, the given equation has 2, 2, 3, 3, as roots.

Equal Surface Projection, or Equivalent Projection. One that represents the whole of the earth's surface on a scale that is uniform as regards areas, and is therefore specially useful in certain meteorological researches.

Equation. Expression of the equality of two quantities or combinations of quantities. In elementary algebra, the elements of an equation are known and unknown quantities. A value of the unknown for which the equality is maintained is called a root of the equation. Equations having a limited number of such values are called determinate. To solve an equation is to determine the value of the unknown. Two or more equations arising from independent conditions form a system of equations. For a system to be determinate, there must be as many equations as there are unknown quantities. In many discussions, equations are used having two or more unknown quantities in a single condition, usually called variables. Equations are numerical when the known or constant elements are given in numbers, literal when letters represent some or all of the known quantities. Equations are classified as algebraic or transcendental, as they involve only the fundamental operations of elementary algebra, or introduce more complicated forms. They are called of first, second, third, etc., degree, according to the largest number of unknown factors in any term. The general equation of any class is one to which all forms in that class may be reduced. The general solution of an equation is obtaining a value for the unknown which will be true in form for all cases. Such solutions have been obtained for equations of the second, third, and fourth degrees. They have been proved impossible for those of higher degree. Algebra is called the Science of the Equation.

Equation. As used by astronomers, a correction which must be applied to the mean value of a quantity to obtain its true value; *e.g.*, the equation of time.

Equation, Annual, of the Moon. The earth's orbit being an ellipse, it is nearest the sun ab. Jan. 1, and most remote July 1. As the attractive force of the sun varies inversely as the square of the distance, the effect upon the moon's motion will be greatest in Jan. and least in July.

Equation of a Locus. One which expresses the relations between the co-ordinates of all points of the locus, and thus gives the law of movement which produces the locus.

Equation of Condition. One which must exist in order that certain conditions may be true; *e.g.*, if m and m′ are the slopes of two straight lines, they will be parallel only when $m=m'$, or perpendicular when $m\,m'=-1$.

Equation of Payments. Finding the mean time at which several sums, due at different times, may be paid in one sum without loss to debtor or creditor. The rule is, reduce the different times to one unit, multiply each sum by its time, and add the products. Divide this sum by the total of sums due.

Equation of the Center. Difference between the position of a planet as seen from the sun, and the position it would have had if its orbit were a circle described with uniform velocity.

Equation of the Equinoxes. Difference between the

position of the equinoxes and the position they would have occupied if the precession were uniform.

Equation of Time. Difference between the time as shown by the sun and the time as it would be given by a perfect clock. It is given in the almanac under the heading Sun Fast and Sun Slow.

Equations. In Chemistry, shortened forms of chemical language, stating that when certain substances are brought together under certain circumstances, certain results will follow; *e.g.*,

$$CaCO_3+2HCl=CaCl_2+CO_2+H_2O;$$

i.e., when calcium carbonate and hydrochloric acid are brought together in the proper proportions, they will react, yielding calcium chloride, carbon dioxide, and water.

Equations, Theory of. Investigation of the properties of equations of any degree in one unknown, with methods of ascertaining, exactly or approximately, the roots of numerical higher equations. The discussion assumes

$$f(x)=x^n+A_1x^{n-1}+A_2x^{n-2}.....A_{n-1}x+A_n,$$

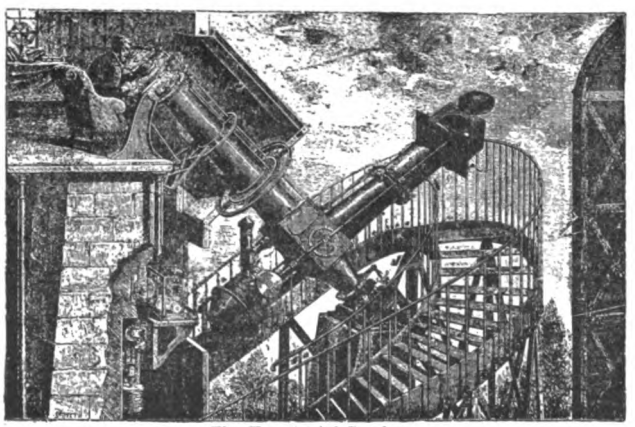
in which x is a general variable, the exponents are all integral, positive, and diminish regularly by unity: the coefficient of x^n is plus one and of all other terms integral. All equations having one unknown may be transformed to form f(x)=o, or made to depend upon a related function having this form. It is shown that: if f(x). be exactly divisible by (x—a), a is a root of f(x)=o: that each root of f(x)=o, when associated with x by a changed sign, forms a factor of f(x): f(x) being of the nth degree, f(x)=o has n. roots: no integer not a factor of the absolute term of f(x). can be a root of f(x)=o: imaginary roots occur in conjugate pairs whose sum is zero and product, positive and real: the number of possible positive and negative roots can be determined from sequence of signs in f(x), each assured permanence indicating a negative, each assured variation of sign a positive, root in f(x)=o: an equation of odd degree must have one real root: of even degree and having negative absolute term, must have two real roots of opposite signs: an equation having no absolute term has one root, zero. Rules based upon these principles determine commensurable roots from the factors of the absolute term, and, through Sturm's Theorem, Horner's Method, and others, find approximately all real roots of numerical higher equations.

Equator, Celestial. Great circle formed by the intersection of the plane of earth's equator extended to the celestial sphere.

Equator, Terrestrial. Great circle of the earth formed by the intersection with its surface of a plane passing through the center and perpendicular to the axis.

Equatorial Belt of Low Pressure. Long, narrow region, over which prevail low barometer, cloudy and rainy weather, nearly encircling the earth near the equator. Ferrel has shown that its existence is principally due to that of the system of n. e. and s. e. trades and the deflection of these winds to the right and left respectively, owing to the rotation of the earth on its axis. See Trough of Low Pressure.

Equatorial Coudé, or Elbowed Equatorial. Form of mounting for telescopes, introduced by Loewy of the Paris Observatory. The polar axis forms a part of the tube, the eye-



The Equatorial Coude.

piece being at its upper end; the object glass is mounted in a short tube attached at right angles to the axis part of the tube, with a plane mirror in front, which may be placed at any angle with the axis.

Equatorial Current. Currents of air that flow from the equatorial side toward the polar side of any locality; *e.g.*, s.w. winds of the n. hemisphere.

Equatorial Telescope. One mounted with an axis parallel to that of the earth; its line of collimation will then describe a circle parallel to the equator. If given a slow motion about this axis by clockwork in a direction opposite to the diurnal motion of the earth, a star may be kept in the field as long as it remains above the horizon. Large telescopes are generally mounted in this way.

Equerry. Official in the Royal household whose principal duty is to accompany the prince to whom he is attached on State occasions.

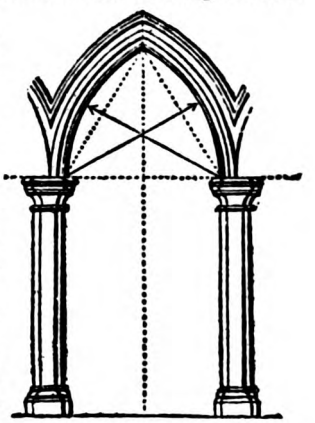
Equestrian Order. Originally the Equites were the cavalry of Rome, 300 in number, 1,800 later. By the Sempronian law they became 123 B.C. a distinct order in the State; the judges were chosen from among them for a time. After 67 B.C. the 14 front rows at the theater were assigned to them. Their insignia were a gold ring and a narrow, purple stripe on the tunic. Their wealth enabled them to undertake the farming of the public revenues. The order lost its political importance after Augustus became Emperor.

Equidæ, or Solidungula. Family of *Perissodactyla*, including the Horses. In the genus *Equus* there is one large hoof on the third toe, the second and fourth digits are represented merely by splints (metapodials) covered by the skin. There is a wide diastema in the jaw, and small canines are present only in males. The first of the seven grinding teeth is early lost and never replaced. American Tertiary deposits have yielded a series of fossils that shows all gradations from five-toed species in the earliest strata down to the one-toed modern Horse. *Eohippus* of the lower Eocene had three toes on the hind feet and five upon the forefeet, though only four were well developed. We next come to an animal about as large as a fox, in the upper Eocene, *Orohippus;* it had three toes on the hind feet and four upon the forefeet, the third digit being most developed. Next, in the Miocene, we have forms with three toes upon all the feet; but *Mesohippus* has rudiments of the fourth digit as splints on the forefeet, *Miohippus*, about as big as a sheep, has the toes nearly equal, and *Anchitherium* has the middle toe largest. In the later Miocene and early Pliocene, *Hipparion* flourished. In this form the lateral toes do not reach the ground. In the later Pliocene was *Pliohippus*, with the lateral toes reduced to splints; and finally, in the Post-Pliocene, appeared our modern Horse.

Equidifferent Series. Difference series of the first order: an arithmetical progression.

Equilateral. Figures whose corresponding sides are equal.

Equilateral Arch. One formed of the two segments of circles having centers at the spring of the arch on each side and describing an equilateral triangle if united at the apex of the arch.



Equilateral Arch.

Equilateral Hyperbola. One whose transverse and conjugate axes are equal.

Equilibrant. A force the effect of which is to balance the combined effects of one or more other forces. It is numerically equal to the resultant, and opposite in direction.

Equilibrium. A system of forces is said to be in equilibrium when the forces acting upon a body simultaneously produce no acceleration, either of translation or rotation. The resultant of such a system of forces is evidently zero. When applied to bodies supported and acted upon by gravity we may have three conditions of equilibrium, stable, unstable, and neutral. A body is stable if the point of support be above the center of gravity, unstable if it be below, and neutral if these two points be coincident. There are thus various degrees of stability and instability. A brick resting on its broad face is far less unstable than when resting on its end. In general the instability of a body is proportional to $\frac{h}{A}$, where A is the area of the base upon which it rests and h the height of the center of gravity above the base. It may be said in general that a body is in stable, unstable, or neutral equilibrium according as the work necessary to expend in displacing its center of gravity is positive, negative, or zero.

Equilibrium of Demand and Supply. Condition of industrial organization in which the volume of production adjusts itself to normal demand, or to the general condition of the market.

Equimultiples. Products of two or more quantities by the same multiplier. They have the same ratio as the quantities.

Equinia. See GLANDERS.

Equinoctial Circle. See EQUATOR, CELESTIAL.

Equinoctial Storm. Any severe storm occurring just before or after either equinox; coincidence, not result.

Equinoxes. Points on the celestial sphere where the ecliptic and equator intersect; also, time when the sun in its apparent annual course crosses the equator, making day and night of equal length. The vernal equinox occurs March 20, autumnal Sept. 22.

Equipage. Equipments for the efficient service of the soldier; also those pertaining to camp and garrison, issued by the quartermaster for strictly post or police purposes, or for service of troops of different arms of the service.

Equipotential Surface. One over which the value of the potential, either gravitational, electrical, or magnetic, is the same at every point. It is clear that no two equipotential surfaces of the same system can intersect, since at their line of intersection we should have two potential values belonging to the same surface.

Equisetaceæ. Family of sub-kingdom *Pteridophyta*, comprising the plants variously known as Horsetail-rushes, or Horse-tails, in allusion to their finely divided branching, or Scouring-rushes, in allusion to their use in scouring floors, the epidermis containing much silica; ab. 20 species are known, all of the single genus *Equisetum*.

Equisetaceæ.

Equisetites. Fossil plants, forerunners of the modern *Equisetum* or Horsetail, having similar jointed stems, internally fluted. They attained a much larger size than any recent species, reaching probably 30 or 40 ft. in height. They closely resembled Calamites.

Equitable Assignment. Irrevocable transfer of a fund or share in action, not enforceable at law, but in equity. The assignee must give notice to debtor in order to protect his rights under the assignment.

Equitable Conversion. Equity treats that as done which ought to be done, hence when a testator directs land to be converted into money or money into land, it is equitably so converted.

Equites. See EQUESTRIAN ORDER.

Equity. That portion of jurisprudence developed by chancery courts in England and their successors in the U. S.; its purpose is to cure the defects of the common law and to supplement it, to prevent a civil wrong going unredressed because no common law remedy is available, to regard substance rather than form, and to conform the rules of jurisprudence as far as possible to the dictates of natural justice.

Equity of Redemption. Mortgagor's right to redeem property after conveyance is absolute at law.

Equivalents. In Geology, formations occurring on the same geological horizon in separated localities.—In Geometry, magnitudes when they contain the same unit of measure the same number of times, regardless of form.

Equivalent Weights. In Chemistry, replacing weights of the elements; term introduced by Wollaston. See VALENCE.

Equivocation. Logical sophism in which the mind deceives itself or others by a double meaning of terms.

Equus. Genus which includes all varieties of the modern Horse, the Ass, Zebra, Quagga, etc. All domestic horses belong to one species, *E. caballus;* the wild ones are descended from some that have escaped and reverted to a feral type. The species is distinguished by the breadth of the hoof, by having warts on both fore and hind legs, and by the long hairs of the tail being evenly distributed from the base down. A wild species with the long hairs restricted to the lower half of the tail has been discovered in Central Asia. This also lacks a forelock and has a short erect mane. The Ass belongs to the sub-genus *Asinus*. This group has warts only on the fore legs, the tail has long hairs only at the end, the hoof is narrow, and one or more stripes appear upon the hind legs, shoulder, and back. Reciprocal crossing between the Ass and Horse give us the Mule and Hinney, the former more ass-like, the father having impressed his characters more strongly.

Era. Division of geological time, not precisely and uniformly marked; more frequently Carboniferous, Devonian, etc., other terms being reserved for other divisions of geologic time, both longer and shorter.

Erased. Heraldic term signifying plucked up by the roots, or torn off leaving a ragged edge; when an even edge is left it is called Coupé.

Erard, SEBASTIEN, 1752–1831. French maker and improver of musical instruments; inventor of the piano with double escapement and of the double-action harp.

Erasistratus, 3d century B.C. Greek physician at Alexandria, writer on anatomy. Fragments of his works remain.

Erasmus, DESIDERIUS, D.D., 1466–1536. Humanist, first editor of Greek New Testament, 1516. B. at Rotterdam, he lived in France, England, Italy, and Switzerland. Originally a monk, he satirized the clergy in his *Praise of Folly*, 1511, and *Colloquies*, 1524. These works contributed to the Reformation, and he was said to have "laid the egg which Luther hatched"; but he was rather a critic than a reformer, and remained neutral, denounced as a heretic by the Sorbonne, but writing *On Free Will*, 1526, against Luther. *Adages*, 1508; *Epistles*. His works were collected in 9 vols. 1541.

Erasmus.

Erastianism. Doctrine of the Church's subordination to the State.

Erastus, or **Liebler,** THOMAS, M.D., 1524–1583. Swiss scholar, prof. of Medicine at Heidelberg 1558, and Basel 1580. A Zwinglian, he was excommunicated at Geneva as a Socinian 1570, and restored 1575. His doctrine of State supremacy over the Church was held in the interest of toleration, and found many adherents in England and elsewhere. His book was circulated in MS. 1568, pub. 1589, and tr. 1659 as *The Nullity of Church Censures*. Selden and others urged his opinions in the Westminster Assembly.

Eratosthenes, 276–196 B.C. B. at Cyrene. Librarian of the Alexandrian Museum; one of the most learned of the Greeks. He wrote upon astronomy, chronology, history and grammar, and computed the earth's circumference by a new and correct method.

Erbia, or ERBIUM OXIDE. Er_2O_3. Beautiful rose-colored magnetic compound; infusible. On heating it gives an intense green light. Sp. gr. 8.64.

Erbium. Er. At. wt. 166.3; sp. gr. 7.1. Very rare element, discovered by Mosander 1843. Its compounds are few and unimportant. It occurs in GADOLINITE and EUXENITE (q.v.).

Ercilla y Zuniga, ALONSO, 1533–1594. Spanish heroic poet, author of the *Araucana*, 1569, an epic of the conquests in S. America, highly valued for literary merit and historic fidelity.

Erckmann, ÉMILE, b. 1822. Alsatian novelist. His partnership with A. Chatrian was formed 1847, and lasted till 1889 with little success till *Dr. Matheus* appeared 1859. Their most popular books were based on recent French history, as *A Conscript of 1813* and *The Invasion*, 1864–65. They dramatized some of their tales, as *Friend Fritz*, 1876.

Erdmann, JOHANN EDUARD, 1805–1892. Prof. Halle 1836. *Hist. Philosophy*, 1866, tr. 1890.

Erdmann, OTTO LINNÉ, 1804–1869. Prof. of Chemistry at Leipzig 1830. Ed. *Jour. für technische u. ökonomische Chemie*, 1828–33; *Jour. für praktische Chemie*, from 1834.

Erebus. Son of Chaos; gloomy space below the earth, through which the shades pass to Hades.

Erebus, MT. Volcano in Victoria Land, 78° S. lat.; ht. ab. 12,400 ft.; discovered 1841.

Erechtheum. Temple of the Ionic order on the Acropolis at Athens. Devoted to the worship of Athene, but named from the hero Erechtheus, son of Vulcan and son-in-law of Cecrops, whose tomb was reputed to be beneath its site, completed 409 B.C.

Erechtheum, Southern Portico.

Erecti. See ANTHROPIDÆ.

Eremacausis. Process of slow combustion; or, according to the theory suggested by Liebig, change which goes on in animal and vegetable matter after death.

Eremobiæ. Order of *Protocœcoideæ*.

Eremoblast. Unicellular plants.

Eretria. City on w. coast of Eubœa, destroyed by Persians 490 B.C.; rebuilt from Athens.

Erfurt. City of Saxony, on the Gera. Its most important industry is the culture of flowers and vegetables, for seed. It had a monastery, once the abode of Luther, and a university, closed 1816. Pop., 1890, 72,371.

Erg, or DYNE-CENTIMETER. Absolute C. G. S. unit of work. It is equal to the work done by the force of one dyne when it acts against resistance through the space of one centimeter. Roughly, it is necessary to expend ab. 1 erg in raising 1 milligram 1 centimeter vertically against gravity. As the erg is a very small unit, it has been found convenient in practice to adopt certain multiples of it; *e.g.* 10^6 ergs form a megalerg or megerg, and 10^{10} an ergten.

Ergometer. Instrument for measuring work. One form absorbs the work in friction, as White's friction brake. Morin's ergometer, on the other hand, measures the energy in the course of its transfer from one body to another by a simple system of springs combined with a direct reading integrator.

Ergot. Sclerotium of *Claviceps purpurea*, a fungus affecting many cereals, more particularly rye; used in medicine to induce contractions of the impregnated uterus, and to diminish congestion of many organs. When mingled with grain used for food, serious epidemics have occurred, in which gangrene and affections of the nervous system were prominent symptoms.

Ergot of Rye.

Ergotism. Chronic affection due to long-continued use of spurred grain or that containing the sclerotium of the fungus *Claviceps purpurea*, and characterized by dry gangrene or convulsive disorders.

Ergten. Unit of work or energy, equal to 10^{10} ergs.

Erian. Devonian; term used by J. W. Dawson.

Eric the Red, b. in Norway ab. 950. He fled to Iceland, visited Greenland ab. 982, and ab. 986 founded a settlement there, which flourished for ab. 4 centuries and then disappeared from history.—His son, LEIF, visited Vinland (probably Mass.) ab. 1000.

Eric XIII., 1382–1459. King of Denmark and Norway 1412–39, and of Sweden till its secession 1437.

Eric XIV., 1533–1577. King of Sweden 1560–68; son and successor of Gustavus Vasa; deposed.

Ericaceæ. Natural family of flowering plants, of the class *Angiospermæ*, sub-class *Dicotyledons*, and series *Gamopetalæ*, comprising 53 genera and ab. 1,080 species, distributed throughout all parts of the earth; commonly called the Heath family.

Ericsson, JOHN, 1803–1889. Swedish engineer, in England 1826–39, in New York from 1839. In 1829 he produced the Novelty locomotive engine with artificial draft at the Rainhill competition. He brought out a steam fire-engine 1832, and a hot-air engine 1833. In 1852 he applied hot air to marine propulsion (S. S. *Ericsson*), but it was not satisfactory. His smaller engines for light powers, pumping, etc., have been very successful. The U. S. S. *Princeton*, built 1843 with screw-propeller under his direction, was claimed as the first application of the screw for propulsion. March 9, 1862, his *Monitor*, just completed, repulsed the *Merrimac* in Hampton Roads: this was the first use of the armed turret in naval warfare. He designed a solar-engine and submerged vessels for torpedo service.—His brother, NILS, 1802–1870, constructed a canal and railroads in Sweden, and was made Baron 1862.

Erie. City of Erie co., Pa., on Lake Erie, with a fine harbor. Its manufactures are mainly of iron and steel. Pop., 1890, 40,634.

Erie, LAKE. One of the Great Lakes of N. America. It lies between Pa., N. Y., and Ohio on the south and Canada on the north, and is drained into Lake Ontario by Niagara River. Area 9,960 sq. miles, extreme length 250 miles, extreme breadth 60 m., max. depth 210 ft., elevation 573 ft., drainage area 39,680 sq. m. In the battle of Lake Erie, Sept. 10, 1813, near the Bass Islands, the U. S. fleet under Perry won a decisive victory over the British, establishing American supremacy on the Lakes and compelling the evacuation of Detroit by the British.

Erie Canal. Connecting the Hudson at Albany and Troy with Lake Erie at Buffalo. The main line, built 1817–25, is 363 miles long and cost $7,200,000. It was originally 28 ft. wide at the bottom and 4 ft. deep, but these dimensions have since been increased to 60 ft. and 7 ft.

Erie Clay. Bed of glacial origin (so named by Sir W. Logan), filling the valleys of rivers in Ontario, and especially on the n. shore of Lake Erie.

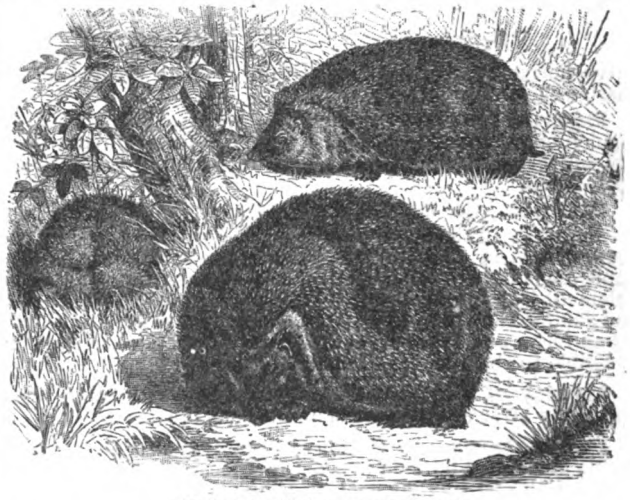
Erie Shale. Mass of shale found in e. Ohio, w. Pa., and southward, forming part of the Upper Devonian strata. It passes e. into the Chemung, Portage, and Genesee. From 300 feet in Central Ohio it thickens to more than 2,000 on the State line, from which point it is lost under the Coal Measures, reappearing in central Pa.

Erigena, JOHANNES SCOTUS, ab. 810–ab. 890. Philosopher, probably of Irish birth, resident at the French court ab. 843–77. In that dark age he was an original thinker, a pantheist and a rationalist, inclining to Greek mysticism rather than to Latin theology, writing against Augustinianism and transubstantiation. He "derived authority from reason, not reason from authority." His chief work is *De Divisione Naturæ*. His memory was condemned 1209.

Erik. See ERIC.

Erin. See IRELAND.

Erinaceidæ (HEDGEHOGS). Family of *Insectivora*, characterized by a back covered with prickly spines that protect the animal when it rolls into a ball by contracting the cutaneous muscles of the belly. The feet are not fitted for digging. There is a zygomatic arch and tympanic bulla. The first upper præmolars are developed to serve as canines.



Hedgehog (*Erinaceus europæus*).

Erinna, ab. 600 B.C. Greek epic and lyric poet, of high repute in her day; friend of Sappho. Only a few fragments remain.

Erinyes. Furies. See EUMENIDES.

Eriocaulaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Monocotyledons*, comprising 6 genera and ab. 325 species, widely distributed throughout the warmer regions of the world; called the Pipewort family.

Eriometer. Optical instrument devised by T. Young for determining the diameters of very minute bodies, as dust par-

ticles on glass. The principle is dependent on the phenomenon of diffraction. A plate of thin metal is pierced with a small round hole ab. $\frac{1}{50}$ inch in diameter, around which at the distance of ab. $\frac{1}{4}$ inch is a circle of smaller holes. If the flame of a lamp be placed immediately behind the central aperture, and the luminous point viewed through the substance to be examined, a ring or halo will be seen surrounding the aperture. By moving the substance back and forth on a graduated scale, a position may be found in which the ring is coincident with the circle of small holes. The distance from the aperture is then read off on the scale, and this becomes a measure of the diameter of the dust particles.

Eris. Goddess who stirs up war and discord. It was she who threw the apple of discord into the assembly of the gods, the cause of the Trojan war.

Eritrea. Italian colony on w. coast of Red Sea, so called 1890. It extends from the Strait of Bab-el-Mandeb n. to ab. 18° N. lat., but the w. boundary is undefined. Italy claims a protectorate over Abyssinia.

Erivan. Armenian town of Transcaucasia, s.e. of Kars; long held by Turks and Persians; stormed by Russians 1827, and ceded by Persia 1828. Pop. ab. 12,000.

Erlangen. Town of Bavaria, 12 m. n. of Nuremberg. Its university dates from 1742. Pop., 1890, 17,565, mostly Protestants, largely of Huguenot ancestry.

Erlau. Town of Hungary, 80 m. n.e. of Pesth, founded ab. 1010; held by Turks 1596–1687; noted for its wine. Pop., 1890, 22,200.

Erlking. Danish or German elf, celebrated by Herder and Goethe.

Erman, Georg Adolf, 1806–1877. Prof. Berlin, geographic explorer and magnetic and meteorological observer in Siberia. *Reise um die Erde*, 1828–30. *Determination of the Gaussian magnetic constants for 1829*, 1846–48. He ed. Russian Scientific Archives.

Ermine, or Stoat. Order of *Mustelidæ*. It has a weasel-like body, is 8–11 in. long, is dexterous in catching rats, sometimes attacks poultry, and emits a foul odor when excited, thus

Ermine (*Putorius erminea*).

resembling the Skunk. It burrows underground, bears 4 to 12 young in the spring. Its color is brown in summer, white in winter with end of tail black. Habitat in both hemispheres. n. temperate and Arctic regions.

Ernest, 1441–1486. Elector of Saxony 1464; founder of a line of princes.

Ernest I., "the Pious," 1601–1675. Duke of Saxe-Gotha; Protestant leader, in command at Lützen, Nov. 16, 1633, on Gustavus Adolphus' death.

Ernest IV., 1818–1893. Duke of Saxe-Coburg 1844; brother of Prince Albert; composer of several operas.

Ernest Augustus, 1771–1851. Fifth son of George III.; Duke of Cumberland; from 1837 King of Hanover, then detached from Britain.

Ernesti, Johann August, D.D., 1707–1781. Prof. Leipzig from 1742. His *Principles of Biblical Interpretation*, 1761, made the basis of a new exegetical school; tr. by Moses Stuart 1822.—His nephew, August Wilhelm, 1733–1801, Prof. at Leipzig 1770, edited Livy 1769.

Ernst, Heinrich Wilhelm, 1814–1865. German violinist and composer for his instrument. His *Elegie* and *Othello Fantasia* still hold a place in the concert repertory.

Ernst, Oswald Hubert, U.S.A., b. 1842. Major of engineers 1882. *Military Engineering*, 1873.

Eros. Cupid or Amor; son of Aphrodite, god of love. His arms were torches and arrows, some golden, kindling love, others leaden, causing aversion; often blind.

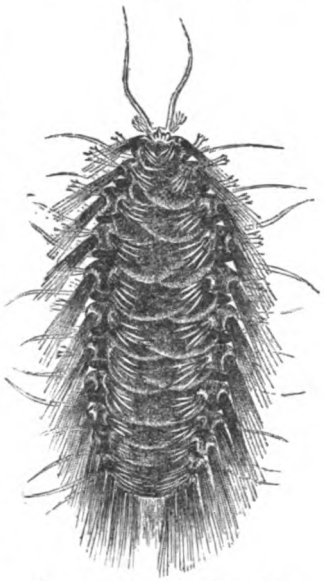
Erosion. Wearing away of rocks by action of the elements. Under this head are included the action of frost and sunshine in splitting rocks, of rain in carrying away the material thus obtained, of Corrosion (q.v.), and of chemical action in loosening and dissolving the material of which the rocks consist.

Erotomania. Violent and insane affection for another person, usually of the opposite sex.

Erpenius, or **Van Erpen,** Thomas, 1584–1624. Prof. Leyden 1613. His *Arabic Grammar*, 1613, was first in the field and was long used. *Rudimenta*, 1620; tr. El-makin's *Hist. Saracenica*, 1625.

Erpetology. See Herpetology.

Errantia (Nereidæ. Notobranchiata, Dorsibranchia, or Gymnocopa). Free-swimming, predacious *Polychætæ* (worms), whose parapodia are well developed and serve as oars. The pharynx can act as a protrusible proboscis. Eyes are present on the head. Here belong *Aphrodite*, with elytra on the notopodia of alternate segments, a few tentacles and palps on the head; *Eunice* and *Diopatra*, with long body, uniramous parapodia, and many tentacles on head; and *Nereis*, with long body, few tentacles on head; the parapodia, sometimes biramous, and bearing composite setæ. Some forms are phosphorescent.



Errantia (*Hermione hystrix*).

Erratic. Bowlders of distant and generally of northern origin, contained in the drift; so called because strangers in the region where they are found. See Drift.

Errazuriz, Federico, 1825–1877. President of Chili 1871–76.

Error, Writ of. Process by which a superior court is enabled to examine and affirm or reverse the judgment of an inferior court.

Ersch, Johann Samuel, 1766–1828. Prof. Halle 1803: father of German bibliography. *Handbuch der Deutschen Litteratur*, 4 vols., 1812–14; *Encyclopädie der Wissenchaften und Künste* (with J. G. Gruber), 18 vols., 1818–28.

Erse. Gaelic dialect, branch of the Celtic family of languages, spoken in the Scotch Highlands.

Erskine, Ebenezer, 1680–1754. Pastor at Stirling from 1731: founder of the Scottish Secession Ch. 1736, merged in the U. P. 1847.—His brother Ralph, 1685–1752, wrote *Gospel Sonnets*, 1720, a queer book of sacred verse, long popular.

Erskine, John, 1509–1591. Scottish layman, active in the Reformation.

Erskine, John, 1695–1768. Law Prof. Univ. Edinburgh 1737–65. *Principles of the Law of Scotland*, 1754; *Institutes* of the same, 1773.—His son John, D.D., 1721–1803, was pastor in Edinburgh from 1758, and a prolific writer: his preaching is described in *Guy Mannering*.

Erskine, Thomas, Lord, 1750–1823. Scottish advocate of highest rank, practicing in England; M.P. 1783; Baron 1806; Lord Chancellor 1806–7. He was a steady Whig, and defended Hardy and Tooke when tried for treason 1794. *War with France*, 1797.—His brother Henry, 1746–1817, was almost equally eminent in Scotland; Lord Advocate 1783 and 1806; M.P. 1806.

Erskine, Thomas, 1788–1870. Scottish layman, whose interests were chiefly in liberal theology. His *Internal Evidence*, 1820, *Essay on Faith*, 1822, and other books, were widely read.

Erubescite. $FeCu_2S_3$. See Bornite.

Erucic Acid. $C_{22}H_{42}O_2$. Mpt. 33°–34° C. It crystallizes from alcohol in long needles, is present in rape-seed oil and in the fat oil of mustard, and is obtained from rape-seed oil by saponifying it with lead oxide.

Eruptive Fevers. Those in which an eruption upon the skin is nearly always present; cerebro-spinal meningitis, break-bone fever, measles, German measles, scarlet, typhoid, and typhus fevers, small-pox, varioloid, cow-pox, and chicken-pox.

Sea-holly (*Eryngium maritimum*).

Eryngo. Herbs of the genus *Eryngium*, natural family *Umbelliferæ*, of wide geographical distribution.

Erysipelas. Acute disease of skin and connecting mucous membranes, marked by patches of superficial inflammation, bright red color, fever, headache, and loss of appetite. It may result in ulceration or gangrene, is moderately contagious, being probably due to micro-organism (*Streptococcus erysipelatis*), and is particularly to be dreaded when attacking those in whom raw surfaces are exposed, or women in childbed. It sometimes seems to arise spontaneously.

Erysipheæ. Order of *Fungi* of the sub-class *Ascomycetes*, whose mycelia infest the green tissues of living plants.

Erythema. Diffused redness of the skin, due to congestion of the capillaries; eruption of scarlet fever is a type.

Erythrin. $C_{20}H_6Br_4O_5C_2H_5K$. Ethyleosin, prepared by the action of ethyl sulphate of potassium upon eosin; soluble in hot water. It dyes wool pink. Methyleosin is similar.

Erythrite, or ERYTHROL. $CH_2OH.CHOH.CHOH.CH_2OH$. Mpt. 112°. Substance found free and combined in many Lichens and *Algæ*; large white crystals which have a sweet taste.

Erythrite. $Co_3As_2O_8 + 8aq$. Hydrous cobalt arsenate, usually with a characteristic reddish tint, though sometimes otherwise colored; found associated with other ores of cobalt.

Erythrophyll. Red coloring matter dissolved in the cell-sap of certain plants, and contributing to the tints of autumn foliage.

Erythropsia. Condition to which all objects appear red.

Erythrosin. $C_{20}H_6O_5I_4Na_2$ or K_2. Salt of tetraiodofluorescein: brown powder, soluble in water, and dyeing wool red; formed by the action of iodine upon fluorescein.

Erzerum. Town of Turkish Armenia in a valley near the head of the Euphrates, at an elevation of 6,200 feet; founded 415 as Theodosiopolis; taken by Arabs 700, by Seljuks 1201, by

Erzerum—Looking West from the British Consulate.

Mongols 1241, by Turks 1517, by Russians 1829 and 1878, but restored to Turkey. It has a cold climate and an active trade. Pop. ab. 60,000.

Erzgebirge. Range between Saxony and Bohemia, containing silver, lead, tin, iron, and cobalt. Length ab. 100 m., greatest height 4,050 ft.

Esarhaddon. King of Assyria ab. 680–668 B.C.; son of Sennacherib.

Esau. Son of Isaac; twin brother of Jacob, who supplanted him.

Escalade. Method of gaining admission to the enemy's works by the use of ladders or other contrivances for climbing from the ditch to the top of the scarp wall.

Escape. Any departure from imprisonment not authorized by law, by one lawfully imprisoned. An officer suffering an escape from process in a civil action is liable in damages to the party procuring the arrest, and in criminal cases becomes an accessary after the fact to the crime of the prisoner.

Escarpment. Steep slopes of the walls of ditches or other cuts, to prevent the easy descent or ascent of the enemy in their efforts to carry the works by assault.

Eschar. Slough of tissue, natural or produced by caustic.

Eschatology. Body of doctrine concerning "the last things"; viz., second coming of Christ, intermediate state, resurrection, judgment, heaven and hell.

Escheat. Reversion of lands to the lord of the fee, or to the State, on the legal failure of natural heirs.

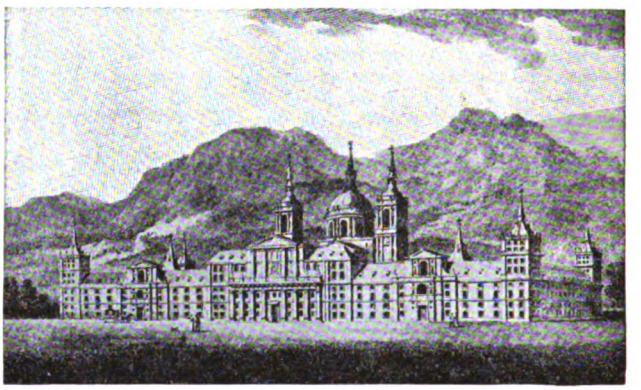
Eschenbach, WOLFRAM VON, d. ab. 1220. Bavarian Minnesinger at the court of the Landgrave of Thuringia, in the Wartburg at Eisenach. *Parzival* is his most famous poem.

Eschenmayer, ADAM KARL AUGUST, 1768–1852. Prof. Tübingen 1811–36. *Philosophy of Religion*, 1818–24.

Escobar y Mendoza, ANTONIO, 1589–1669. Spanish Jesuit; prolific writer. His *Moral Theology*, 1646, was widely circulated, attacked by Pascal, and condemned by four French parliaments.

Escobedo, MARIANO, b. 1827. Mexican general, who resisted the French invasion 1862, defeated Miramon at San Jacinto Feb. 1, 1867, and captured Maximilian at Querétaro May 14.

Escorial. Collection of buildings 30 m. n.w. of Madrid, consisting of a monastery, church, palace, and pantheon, or royal burial-place; erected by Philip II. 1563–84. They contain many



The Escorial.

masterpieces of painting and rare manuscripts, and are built in the form of a gridiron in honor of St. Lawrence. Size ab. 780 by 620 feet.

Escort of Colors. Regimental guard, composed of one sergeant, the color-bearer, and two soldiers. The color is escorted by this guard to the color company on its parade ground, and in like manner back to its place of deposit.

Escorts of Honor. Composed of cavalry, artillery, or infantry, or of all arms; detailed to receive and escort personages of high rank, civil or military.

Escosura, PATRICIO DE LA, 1807–1878. Spanish dramatist and novelist; envoy to Germany 1872–74. *Constitutional Hist. England*. 1859.

Escribed Circle. One to which one side of a rectilinear figure and two other sides extended are tangent. A plain triangle may have three escribed circles.

Escrow. Written instrument, delivered by the obligor to a third person, to take effect upon a prescribed contingency. In some cases, the law gives effect to it from its first delivery.

Esculapius. See ÆSCULAPIUS.

Escurial. See ESCORIAL.

Escutcheon. In Heraldry, shield on which arms are displayed.

Esdraelon, PLAIN OF. Rich plain of Galilee, ab. 15 by 18 m., with several projections. Here armies have in all ages contended, Canaanites, Philistines, Assyrians, Greeks, Romans, Crusaders, Turks, and Frenchmen. Biblical name, Jezreel.

Esdras. Four books, EZRA (q.v.) and Nehemiah canonical, the others apocryphal.

Eserine. Alkaloid obtained from Calabar bean; used to cause contraction of the pupil.

Esker. Long ridge of drift-material usually occupying the middle of a glacial valley: distinguished from a Rame.

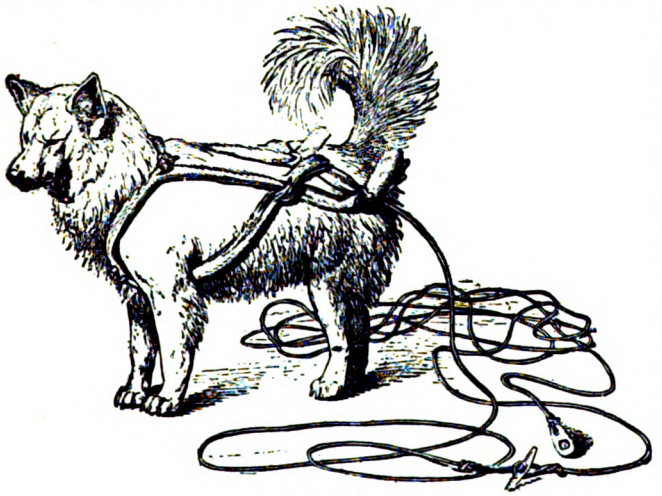
Eskimo, ESQUIMAU, or INNUIT. Indians of Arctic America and adjacent part of Asia. They number ab. 40,000, of whom

10,000 are in Greenland and 1,400 in n. Labrador. They have Mongolioid affinities. The skull is narrow, the face round, nose flat, hands small and well-formed, average stature 5 ft. 4 inches. A third of the Greenlanders have a mixture of Scandinavian blood. A majority of the Greenland and Labrador Eskimos are Christians. They are expert in making sledges, kayaks (canoes), and harpoons with detachable point and float on the string. They also sew skin garments neatly, with sinew-thread and bone needle. They are flesh eaters, and depend on

Eskimo Winter Station, Greenland.

seals, whales, reindeer, etc., the skins, entrails, and bones of which serve for material for dress, utensils, and weapons. They dwell in skin tents in summer, in iglus (*i.e.*, beehive huts of snow or turf), and caves in winter. They are peaceable among themselves, but fierce enemies of the Indians of n. Canada. They have many virtues, but are lax in sexual relations. Their government is semi-communistic. The more southern of Greenland Eskimos publish a journal and have a native literature.

Eskimo Dog. Size of mastiff; of white and black or dingy color, with sharp muzzle and bushy tail; scarcely to be distinguished from the Arctic wolf, except in its upturned tail. It



Eskimo Dog.

does not bark but howls. They are used as beasts of burden and for drawing sledges, with which they cover more than 50 miles a day.

Esmann, GUSTAV FREDRIK, b. 1860. Danish dramatist.

Esmarch, FRIEDRICH, b. 1823. Danish surgeon: prof. Kiel 1860; prominent in the wars of 1864 and 1870–71. *War Surgery*, 1885.

Esmarch's Bandage. Rubber or elastic bandage, used in surgery to expel blood from a limb. It is applied from the distal part toward the trunk.

Esmark, JENS, 1763–1839. Danish writer on mineralogy.

Esmarkite. 1. Products of alteration of the mineral iolite. 2. Datolite.

Esneh. Egyptian town on the Nile, lat. 25° 15′ N.; site of a temple of the Roman period, mainly buried or concealed by surrounding houses.

Esoteric. In ancient mysteries, and in sundry systems of philosophy or theology, doctrines revealed to the initiated only; opposed to Exoteric, such as were open to any.

Esox. See HAPLOMI.

Esparsette. See SAINFOIN.

Espartero, BALDOMERO, DUKE OF VITTORIA, 1792–1879. Spanish general who served in S. America 1815–25, and quelled the Carlist insurrection 1833–39; Regent 1841–43; Premier 1854–56.

Esparto Grass. *Macrochloa tenacissima* or *Stipa tenacissima*. Perennial coarse grass used for making hats, baskets, etc., and in the manufacture of paper; native of the Mediterranean region.

Esparto Grass (*Stipa tenacissima*).

Espinasse, JULIE JEANNE ELEONORE, DE L', 1732–1766. French social queen, admired by D'Alembert and remembered for her *Letters*, pub. 1809.

Espinel, VINCENTE, ab. 1550–1634. Spanish poet, romancer, and musician. His *Marcos de Obregon*, 1618, supplied Le Sage with some materials for *Gil Blas*. He tr. Horace's *Art of Poetry*, and some of his odes.

Espinosa, GASPAR DE, ab. 1475–1537. Chief-justice of Darien 1514. He founded Panama 1518, headed many expeditions against the Indians, and aided Pizarro in his second expedition to Peru 1526.

Esprit de Corps. Spirit of attachment and pride in a military or other body, whereby its honor is jealously guarded and its reputation and success made the especial care of each of its members.

Esprits Forts. Men who, especially in religion, jeered at the opinions of the majority of their fellows. Voltaire was the head of this school of writers.

Espronceda, JOSE DE, 1810–1842. Spanish epic and lyric poet.

Espy, JAMES POLLARD, 1785–1860. U. S. Meteorologist 1843; author of *Philosophy of Storms*, 1840, and Reports on Meteorology. Inventor of the Whirled Psychrometer, founder of accepted modern views as to the rale of aqueous vapor and latent heat in atmospheric phenomena.

Espy's Rule. Rather crude approximation, that the height (in feet above the observer) of the bases of forming cumuli is 300 times the depression of the dewpoint (in Fahrenheit degrees at the observed locality).

Espy's Theory OF STORMS. Development of the ideas first advocated by Espy 1830–36 and subsequently elaborated in his reports and lectures. Ascending air cools by expansion, then its moisture condenses, cloud and rain are formed, latent heat is evolved, and the cloudy air rises faster than before; thus an indraft is formed and the storm fed. He overlooked the mechanical law requiring such indraft to be attended by a whirling movement; but, with this addition, his views form the foundation of modern meteorology.

Esquiline Hill. One of the seven hills of Rome. The Church of Santa Maria Maggiore is its most conspicuous building.

Esquimaux. See ESKIMO.

Esquire. In Middle Ages, a knight's attendant and armor-bearer. In modern times, title of various meaning; in the U.S., of mere courtesy.

Esquirol, JEAN ÉTIENNE DOMINIQUE, 1772–1840. French physician, noted for care of the insane and reforms introduced therein. *Mental Maladies*, 1838.

Esquiros, HENRI ALPHONSE, 1814–1876. French author, imprisoned for his *Gospel of the People*, 1840; in England 1851–69; member of the Assembly 1848 and 1871. *Charlotte Corday*, 1840; *Hist. Montagnards*, 1847; *Future Life*, 1857; *Holland*, 1859; *England*, 1859–70.

Esquivel, JUAN DE, ab. 1470–ab. 1519. Spanish conqueror and Gov. of Jamaica 1509.

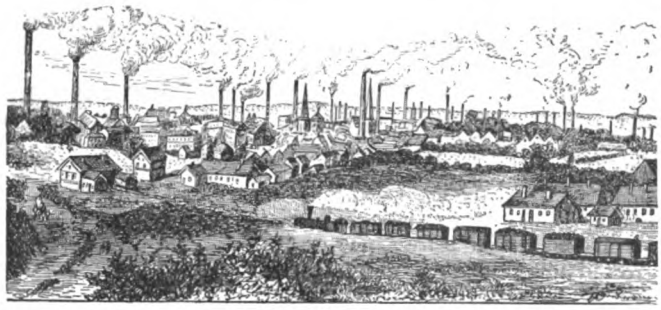
Ess, LEANDER (or JOHANN HEINRICH) VAN, 1772–1847. Benedictine monk 1790; prof. at Marburg 1813–22; German translator and editor of the Bible. His library was bought for Union Theol. Sem., N.Y.

Essaad Effendi, MOHAMMED, b. 1790. Turkish historiographer. *Destruction of the Janizaries*, 1826.

Essays and Reviews. Book pub. in London 1860 by F. Temple, D.D., R. Williams, D.D., B. Powell, F.R.S., H.B. Wilson, C.W. Goodwin, M. Pattison, and Prof. B. Jowett. It was a land-

mark in the development of Anglican theology, and called forth much discussion and several replies.

Essen. Town of Prussia, 25 m. n.e. of Düsseldorf. It is in



Essen.

a region of coal-mines, and is best known as the site of Krupp's great iron and steel works. Pop., 1890, 78,723.

Essen, HANS HENRIK, COUNT OF, 1755–1824. Swedish general.

Essence. Properties vital to the existence and identity of a thing.

Essenes. Ascetic and mystical Jewish sect. They were mostly celibates and hermits, did not offer animal sacrifices, abstained from flesh, and exceeded the Pharisees in rigor of observances. Though prominent ab. 110 B.C.–A.D. 70, the N.T. does not directly mention them.

Essential Oils. Volatile oils obtained from plants, either by distillation of the plant with steam, or by the action of a solvent. They possess the characteristic odor and properties of the plant.

Essential Sign. That which attaches to any quantity as the result of all the indicated operations; *e.g.*, all even powers of real quantities are essentially positive.

Essequibo. River of British Guiana 625 m. long, unfavorable for navigation. Venezuela claims that this river bounds British territory, but Gt. Britain claims much to the westward.

Essex. Early Saxon kingdom n. of the Thames, containing London; subject to Wessex 825.

Essex. See SWINE.

Essex, ROBERT DEVEREUX, SECOND EARL OF, 1567–1601. English courtier; after 1588 favorite of Elizabeth; Lord-lieut. of Ireland 1599; failing to repress a rebellion of the Irish, he

Robert Devereux, Earl of Essex.

was deprived of all his honors, and beheaded for treason.—His son and namesake, 1591-1646, Third Earl 1604, took command of the Parliament's army 1642, and fought sluggishly and ineffectively against Charles I.

Essex Junto. Group of politicians, mostly of Essex co., Mass., ab. 1781, pronounced in their advocacy of a closer federal union. The name was long used and more widely applied.

Essling, BATTLE OF. May 1809, between Austrians and French. See MARCHFELD.

Essonite, or HESSONITE. Variety of the mineral garnet; also known as Cinnamon Stone.

Establishment of a Port. Mean interval between the time of high water at any place and the time of the moon's transit over the meridian of the place.

Estaing, CHARLES HECTOR, COUNT D', 1729–1794. French general who commanded a fleet sent 1778 to assist the Colonies against Great Britain, and aided Gen. Lincoln in an attack on Savannah Oct. 1779; guillotined.

Estate. Interest in property, as distinguished from the property itself; in quantity it is freehold, *i.e.*, for a life or longer, or less than freehold, *i.e.*, for years, at will and by sufferance; as to enjoyment, it is in possession or in expectancy; as to owners, it is several, common, joint, in coparcenary or by entirety.

Estates of the Realm. In England, nobles, clergy, and commons. In Scotland, prior to 1707, Parliament. Sweden had four estates until 1865 (the commons being divided into bourgeoisie and peasantry), each separately organized; since 1865 it has but two legislative bodies. Both term and thing are an inheritance from feudalism. In England, the term Fourth Estate sometimes designates the Press, because of its influence on public affairs.

Este, HOUSE OF. Italian family, long heads of the Guelph party; patrons of art and literature. Eminent names are Azzo VII.; Alfonso I., celebrated by Ariosto; Ercole II.; Alfonso II., associated with Tasso. A German branch was founded by Welf IV., Duke of Bavaria 1070, ancestor of the sovereigns of Great Britain. Rinaldo by his marriage united the German and Italian houses. The male line became extinct 1803.

Esterhazy de Galantha. Princely family of Hungary, raised to distinction by PAUL, 1635–1713, Field-marshal 1665, conqueror of the Turks at Buda 1686; Prince 1687.—NICHOLAS, 1765–1833, was Austrian Ambassador to France, England, and Russia, and a patron of art.—His son, PAUL ANTON, 1786–1866, was envoy in London 1830–38. They owned vast estates, heavily encumbered.

Esther. Seventeenth O. T. book, describing the elevation of a Jewish maiden, Hadassah, to be queen of Ahasuerus, commonly identified with Xerxes. It has no mention of God or of prayer. Six additional chapters in the Septuagint are regarded by Protestants as apocryphal.

Esthonia. Province of Russia s. of Gulf of Finland; held by Denmark 1219–1346, then by the Teutonic knights, and by Sweden 1561–1710. Area 7,818 sq. m.; pop., 1889, 392,738, mostly of German and Finnish origin.

Esthonian. Language of the people of the same name (now included in Russia) and related to the Finnish.

Estivation. See ÆSTIVATION.

Estoile. In Heraldry, the six-pointed star.

Estoppel. Act or declaration so relied on by another that the maker is not permitted to contradict it by the truth. It may be by record, *e.g.*, a judgment, by deed, or *in pais;* the last is also called equitable.

Estovers. Supplies for fuel, fences, etc., allowed by law to the tenant of agricultural lands.

Estray. Straying animal whose owner is unknown; the manner in which it is to be dealt with by the finder is generally regulated by statute.

Estrées, GABRIELLE D', ab. 1571–1599. Mistress of Henry IV. of France, daughter of Antoine d'Estrées, Henry's grand-

Gabrielle d'Estrees.

master of artillery. For nine years she exercised undisputed sway over the King, and he was preparing to make her Queen of France when she died of apoplexy or poison.

Estremadura. Coast province of Portugal on the Tagus. Area 6,876 sq. m. It is hilly and fairly fertile, and contains the capital Lisbon. Pop. ab. 952,000.

Etat-Major. Personnel of a special corps of officers charged with direction of the details of military administration of an army, army corps, division, brigade, or particular arm of the service. Jomini says that a good Etat-major is more durable than the genius of a single man; it preserves the traditions and is the best safeguard of an army. It is to an army what a skillful minister is to the State. It seconds the chief, and foresees and prevents mistakes when he is unskillful. In European armies the Etat-major or staff is particularly attended to; a staff school supplying the theoretical instruction, and service for a period of years in the army the practical, before selection is made for transfer to the Etat-major. The German staff gained an enviable reputation for its efficient services in the war of 1870.

Etching. Florentine goldsmith Finiguerra invented this graphic art in 1452. Ab. 1512 it went into more general use, iron, steel, brass, and copper plates being used. Now copper plates of the best quality are used, being rolled and hammered to afford a uniform density, so that the acid may attack it evenly. The etching ground is composed of 50 parts of white wax, 30 of gum mastic, and 15 of asphaltum carefully blended with heat. This is reduced to the consistency of printers' ink with oil of lavender and worked evenly over the warmed copper plate, in a thin coating, the oil of lavender being eliminated by heating the plate over a spirit lamp. The surface is evenly blackened by a smoking wax taper. The edges and back are protected by etching varnish or an alcoholic solution of asphaltum. The drawing is scratched with the etching-needle through the etching ground, exposing the copper. The plate is then placed in the etching bath, formerly dilute nitric acid. A mixture of potassium chlorate 20 parts, hydrochloric acid 100 parts, and water 880 parts is substituted for the former. The temperature should be 90° F. The bath etches the copper, where exposed. The ground is removed by turpentine and a proof in ink is taken. If any lines need strengthening, the others may be protected by varnish and the plate placed again in the bath. It is finished by use of the etching-needle and burnisher directly upon the plate. By steel-facing the plate its durability is much increased. The impressions upon paper are made by inking the plate, rubbing off the ink not in the etched lines, and impressing the paper upon the plate.

Etching, CALLIGRAPHIC. Drawing is made on a copper plate with common pen and ink. When the ink is dry, the plate is covered with a thin etching ground and smoked. It is placed in cold water for half an hour, which softens the ink, so that, when rubbed with flannel, the ink, with the varnish covering it, come off together, the design showing on the clear copper, while the ground surrounding the lines remains unaffected. The plate is then placed in the etching bath.

Etching, DRY-POINT. This is not true etching. A copper plate is placed in a bath of very weak nitric acid for two minutes, and then washed in water. This gives the plate a darkish tone without affecting the surface otherwise. The drawing is made on the plate with the etching points, and the strongest lines are scratched deeply into the plate, making the bur high, as no metal is removed from the plate, it is only displaced. In printing, the burs hold a certain portion of the ink, which gives a velvety tone in connection with the line. The life of such a plate is short, the bur being soon destroyed in the printing processes.

Etching, SOFT GROUND. Equal parts of ordinary etching ground and tallow are melted together, made into balls and wrapped in open grained silk; the hot plate is rubbed with these, and enough of the ground will be deposited to form a protection against the acid. The plate is smoked lightly and a piece of thin paper laid upon it, on which the design is sketched with a lead pencil. The varnish will attach itself to the paper in proportion to the amount of pressure that is applied, and when the paper is lifted the lines drawn with the pencil will bring the ground from the plate leaving the copper bare, and thus show each line as bright yellow against the dark smoked ground. The plate is then placed in the etching bath.

Etching on Glass. Accomplished by covering the glass with a layer of wax, tracing the characters to be etched by a sharp-pointed instrument, and then exposing the whole to hydrofluoric acid, which attacks the glass but not the covering.

Eternal Alliance. Concluded 1516 between eight Swiss Cantons and France. Zurich, Uri, Schwyz, and Basle refused to join.

Etesian Winds. In Europe and n. Africa about the summer solstice n. and n.w. winds are prevalent; these have been called Etesian since the times of the ancients, who also called them somniculosi, from their ceasing to blow in the night.

Ethal. See CETYL ALCOHOL.

Ethane. $CH_3.CH_3$. Dimethyl. Ethylhydride. Gaseous hydrocarbon of the marsh gas series; one of the components of natural gas; prepared from methyliodide and sodium. It burns readily to water and carbonic acid gas, resists the action of reagents very strongly, but can be acted upon by chlorine in the sunlight, giving chlorine substitution products, as ethyl chloride.

Ethelbald. King of Mercia 716–755. He subjected all Britain s. of the Humber, but was conquered by the Celts at Burford 752.

Ethelbert. 1. King of Kent 560–616, converted by Augustine 597. He gave the first written code. 2. King of E. Angles 790–92. 3. King of Kent, Essex and Sussex 852; of Wessex 860–66.

Etheldreda, ST. Daughter of a king of East Anglia in the 7th century. In the Middle Ages she was popularly known as St. Audrey, and a famous fair was named after her.

Ethelred I. King of England 866–871; brother of Alfred.

Ethelred II., THE UNREADY. 968–1016. King of England 978–1016; son of Edgar and Elfrida. Pressed by the Danes he made an alliance with the Normans; married Emma, daughter of Duke Richard, 1002, and was driven to Normandy 1014 by Sweyn.

Ethelwolf. King of England 836–858; son of Egbert; defeated the Danes 851; married a daughter of Charles the Bald of France 856.

Ether. Used as anæsthetic, more freely in the U. S. than elsewhere, and is regarded as safer than all other anæsthetics, except when disease of the kidneys exists, the proportion of deaths to the number of administrations being 1 to 16,677. In overdoses it causes death by paralyzing the centers which control respiration. Its anæsthetic and intoxicating effects were long known, but it was not used practically until 1846, when it was employed by Dr. W. T. G. Morton of Boston to relieve the pain of extracting teeth. Shortly afterward it was used in surgical operations. Priority of discovery was claimed by Dr. C. T. Jackson, but Morton is usually regarded as having best right to be termed its discoverer. U. S. Government paid Morton $100,000 for his patent for the application. It is sometimes taken internally to relieve pain. In certain parts of Ireland it is used as an intoxicant in place of alcoholics, and produces a form of drunkenness which is rapidly recovered from, thus allowing its users to indulge with great frequency. See ETHYL ETHER.

Ether. Extremely attenuated substance filling the intermolecular, interplanetary, and interstellar spaces, and by its vibration conveying light, heat, and other forms of radiant energy from one body to another. See ÆTHER.

Ethereal Oils. Those oils in fruits and flowers to which these owe their fragrance and taste; obtained by distillation with steam. Some are hydrocarbons of the terpene class, others contain oxygen as well as carbon and hydrogen; *e.g.*, oil of bitter almonds.

Ethereal Salts. Compounds, composed of an alcoholic or hydrocarbon radical united with an acid group; *e.g.*, ethyl acetate, $CH_3COO.C_2H_5$. Mostly they are liquids or solids having a pleasant odor and taste, found in flowers and fruits. They are made by introducing an alcoholic radical in an acid, and used as artificial flavoring extracts; also known as compound ethers and esthers.

Etherege, or **Etheredge,** SIR GEORGE. ab.1636–ab.1690. English dramatist. *Man of Mode*, 1676.

Ether Engine. One in which the volatile vapor of ether was used as a motor vehicle. Owing to its low boiling-point, a small amount of heat will generate a considerable vapor pressure. It was proposed first by Dr. Edmund Cartwright 1797. Du Trembley 1842 in France used steam in an ordinary engine, condensing it on a surface in contact with ether. The ether being thus heated at the temperature due to fifteen inches of vacuum in the condenser, gave a vapor of 50 lbs. pressure per sq. inch above the atmosphere which was used in a second cylinder and condensed to be used again. Vessels of 200 to 651 H.P. were fitted with these engines, but the danger of fire and explosions from leakage of vapor has caused their abandonment. Such engines require very cold condensing water and a great deal of it. See CARBON DISULPHIDE ENGINE.

Etheridge, JOHN WESLEY, Ph.D., 1804–1866. English Wesleyan, writer on Oriental topics.

Ethers. An ether is an oxygen compound considered to be derived from an alcohol by the replacement of the hydroxyl hydrogen with a hydrocarbon radical; as $C_2H_5.O.C_2H_5$, ethyl ether, from ethyl alcohol, $C_2H_5.OH$. It may also be regarded as an oxide of a hydrocarbon univalent radical, as methyl ether $(CH_3)_2O$. Most of the ethers are liquids. The name is also given to ethereal salts.

Ethers, MIXED. See MIXED ETHERS.

Ethics. Science of morality, which may be variously determined by pleasure, perfection, duty, or divine authority. It is peculiarly distinct from the ordinary sciences, in that its

object matter is some ideal end, fact, or condition, which subordinates everything else to it as a means.

Though one of the first fields of thought investigated by the awakening human mind, it has as yet failed to obtain definite and generally accepted limits and bases. This probably arises from its subject matter not being something conceived of as actually existing in some ascertainable form, such as physical or mathematical laws, or even psychology and theology; but what should be, what the human will should seek either as its reasonable end or its required duty. With the Greeks, indeed, ethics was invariably a search for the first of these, the *summum bonum*, or ultimate object of reasonable human action, an inquiry, what is man's true well-being, what is the nature of virtue, or of happiness? In more modern speculation it has been rather a study of the principles of duty or of the moral law, the effect on the individual's happiness being secondary, though not to be neglected.

Moreover, the study of ethics looks upon mankind primarily as individuals, not as societies; it is thus distinguished from politics, though the field of the two must overlap in many places, and they have often been identified.

In all treatments of the subject, ancient and modern, these subjects are investigated: 1. The real Well-being or Good of individual men; 2. The nature and means of attaining either Virtue or Pleasure; 3. The principles and detailed requirements of Duty, or the Moral Law; 4. The nature and origin of our Moral Faculties; 5. The Freedom of the Human Will. The subject is more or less closely connected in all systems with Theology, Psychology, Politics and Jurisprudence, and in the most recent discussions with Biology and general Sociology.

As early as the 5th century B.C., in the midst of the speculations on the nature of the outside world characteristic of awakening philosophy, in at least three men, Pythagoras, Heraclitus, and Democritus, a large element of ethical thought and teaching appears. The Sophists followed, who in their teaching of how best to get on in the world were led to develop at least the prudential side of morality.

But it was the dialectical method and the strong human personality of Socrates that brought ethics into the position of central interest which it always afterward maintained in ancient thought. Plato and Aristotle developed his views and extended the rigid investigation of moral science, while the contemporary Cynic and Cyrenaic schools already gave full force to the antithesis between Virtue and Pleasure. This opposition is the most evident and popular mark of distinction between the Stoic school, founded by Zeno, and that of Epicurus. These two threads continue through the remaining period of ancient philosophy.

After the prevalence of Christianity, the moral code to which it requires obedience was generally accepted. The perception, however, on the part of the schoolmen, that an ethical system might be constructed merely for our natural capacities, gave rise to an inconsistency that is characteristic of mediæval thought.

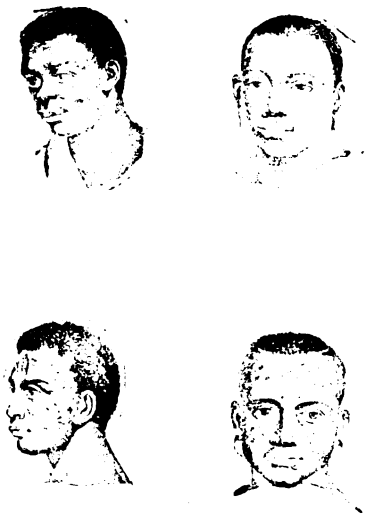
In modern philosophy the great difference of opinion has been between the two views of the origin of our moral ideas. These are known, roughly speaking, as Intuitionism or Common Sense, the belief that there is a necessary moral code which is imposed upon us by God, and that we are given faculties which enable us to recognize its requirements; and Utilitarianism, which teaches that enlightened Self-interest and Social Utility are the only sources and proper criteria of moral judgments. With the former view, generally speaking, are connected the names of Clarke, Butler, Reid, Kant, and Whewell; with the latter, Nobbes, Locke, Hume, Bentham, Paley, Helvetius, Comte, Hegel, James and John Stuart Mill.

The conception of evolution has profoundly modified ethics, as it has every other department of human thought, and the current ethical controversies therefore include an element introduced by biological and general sociological science. Herbert Spencer and Leslie Stephen especially represent this application of the inductions of physical science to the problems of ethics.

Ethiopia. Region comprising Abyssinia and parts of southern Arabia. The Ethiopians, though unknown to the Hebrews as kinsmen, are a branch of the Semitic race.

Ethiopian Province. Zoölogical region, including s. Arabia and Africa s. of the Atlas Mountains. Animals peculiar to this area are the Hippopotamus, Giraffe, Hyrax, Aardvark, Antelopes, Baboons, Lion, Ostrich, and African Elephant. There are no Bears, Deer, nor Sheep.

Ethiopian Race. Characterized by black or dark-brown skin, close, crisp, curly (woolly) hair, narrow, elongated skull, prominent jaws (prognathous), with oblique alveolar portion, thick lips, short, flat nose, and retreating forehead and chin; facial angle only 75°. They inhabit Central and S. Africa, and are Negroes, Kaffirs, Bushmen, and Hottentots; of doubtful origin and mixed blood. The Galla and true Abyssinians are not included, but the negroes of Soudan are often also thus designated. True Ethiopians include the Nomadic Agow, who constitute half the population of Abyssinia, the Falasha, 200,000 Jews of Abyssinia, and the Bidja, Nomadic Mohammedans, living in the mountains w. of the Red Sea, s. of 20° n. lat. Anciently these different peoples were more civilized than now.



Ethiopians.

Ethiopic Language and Literature. This language is sometimes called Geëz. It is an African branch of the Semitic dialects, spoken in Abyssinia, with a literature "wholly of Christian origin and content, coming down from the 4th century of our era; its earliest monument is a version of the Bible."

Ethiops Martialis. Black substance, composed of mercuric sulphide and sulphur; used in medicine.

Ethmoid Bone. Single bone, containing many small cavities and forming the roof of the nasal cavities.

Ethmopalatine. Process from the ethmoid in front of the eye, connecting with the palatopterygoid bone.

Ethnography. That branch of the science of ANTHROPOLOGY (q.v.) which collects and systematizes the facts relating to civilization and the relations of races of man, both ancient and modern, historic and prehistoric, such as methods of procuring food, kinds of tools, the architecture, commerce, industries, marital relations, literature, art, religion, morals, progress of culture, etc. Closely related to Archæology and Philology. Description of the various races are given under their respective titles.

Ethnology. Facts of ETHNOGRAPHY (q.v.) when treated theoretically as a complete science or philosophy of civilization and human progress.

Ethyl. $CH_3.CH_2-$ Hydrocarbon radical or group, which enters into the composition of numerous organic compounds: such as ethyl alcohol, $C_2H_5.OH$; ethyl sulphate, $(C_2H_5)_2SO_4$, and ethyl acetate, $C_2H_5.C_2H_3O_2$.; thought to be derived from ethane by the removal of one hydrogen atom.

Ethyl Acetate. See ACETIC ETHER.

Ethyl Alcohol. See ALCOHOL.

Ethyl Aldehyde. See ACETALDEHYDE.

Ethylamine. $C_2H_5.NH_2$. Derivative of ammonia, in which hydrogen has been replaced by the ethyl group; gas, with the odor and properties of ammonia, produced by the combination of ethyl chloride and ammonia and the decomposition of this product by an alkali.

Ethylaniline. $C_6H_5.NH.C_2H_5$. Bpt. 204° C. Aniline in which part of the hydrogen of the NH_2 group has been replaced by the ethyl group; liquid with an odor like that of aniline; produced by heating together aniline salts and alcohol. The ethylaniline of trade is largely diethylaniline.

Ethylbenzene. $C_6H_5.C_2H_5$. Hydrocarbon, boiling at 136° C.; produced from ethyl chloride and benzene in the presence of aluminum chloride.

Ethyl Benzoate. $C_6H_5COO.C_2H_5$. Bpt. 213° C. Benzoic ether; liquid of agreeable odor, prepared by the action of hydrochloric acid gas upon a solution of benzoic acid in alcohol.

Ethyl Blue. See ETHYLENE BLUE and METHYLENE BLUE.

Ethyl Bromide. $C_2H_5.Br$. Bpt. 38 C°. Bromine combination of the ethyl group; liquid with a low boiling point, which burns with a green flame, produced by the action of phosphorus bromide or hydrobromic acid upon alcohol.

Ethyl Chlorcarbonate. O:C:Cl.OC_2H_5. Bpt. 94° C. Chlorcarbonic ether; liquid of pungent odor, prepared by the action of carbonyl chloride upon alcohol; used in making the methanes.

Ethyl Chloride. C_2H_5Cl. Bpt. 12.5° C. Colorless liquid with an ethereal odor, slightly soluble in water; made by heating ethyl alcohol with sodium chloride and sulphuric acid; formerly used as an anæsthetic.

Ethyl Cyanide. $C_2H_5.CN$. Propionitrile; liquid of agreeable odor, produced by the action of potassium cyanide upon ethyl iodide. Propionic acid is prepared from it by the action of water.

Ethylene. $CH_2:CH_2$. Olefiant gas; gaseous hydrocarbon, prepared by the action of very hot sulphuric acid upon alcohol. It burns with a luminous flame, and is one of the important illuminants present in coal gas. It combines directly with bromine and chlorine.

Ethylene Blue. See METHYLENE BLUE.

Ethylene Bromide. $CH_2Br.CH_2Br$. Dibromethane. Bpt. 132° C. Heavy liquid of pleasant ethereal odor; made by passing ethylene into bromine.

Ethylene Chloride. $CH_2Cl.CH_2Cl$. Bpt. 84° C. Oil of the Dutch chemists; heavy liquid, formed by the union of ETHYLENE (q.v.) with chlorine.

Ethylene Glycol. See GLYCOL.

Ethylene Lactic Acid. See HYDRACRYLIC ACID.

Ethyl Eosin. $C_{22}H_{11}Br_4O_5K$. Potassium salt of tetrabromfluorescein ethyl ether. It dyes wool red. See EOSIN.

Ethyl Ether. $C_2H_5.O.C_2H_5$. Bpt. 35° C. Ether, or sulphuric ether, of trade; liquid produced by the action of sulphuric acid upon alcohol. It is representative of a class of ethers. It possesses a powerful odor, is much used as an anæsthetic, and also in pharmacy and as a solvent. See ETHER.

Ethyl Green. $C_{27}H_{35}N_3Cl_3BrZn$. Produced by the action of ethyl bromide upon methyl violet combined with zinc chloride. Green powder, readily soluble in water; used in wool, silk, and cotton dyeing, as bluish green.

Ethylidene Chloride. $CH_3.CHCl_2$. Bpt. 57° C. An isomer of ethylene chloride; heavy liquid, prepared by the action of phosphorus pentachloride upon acetaldehyde; a by-product in the manufacture of chloral. It is an anæsthetic.

Ethylidene Lactic Acid. See LACTIC ACID.

Ethyl Isosulphocyanate. Ethyl mustard oil. See MUSTARD OILS.

Ethyl Iodide. $CH_3.CH_2I$. Bpt. 72° C. Very heavy liquid, commonly prepared by the action of phosphorus and iodine upon alcohol. It turns red on exposure to the light, and is much used to introduce ethyl groups into organic compounds.

Ethyl Mercaptan. $C_2H_5.SH$. Bpt. 36° C. Liquid with an intensely disagreeable odor, made by heating ethyl bromide with alcoholic potassium sulphhydrate. Upon oxidation it yields ethyl sulphonic acid.

Ethyl-Methyl Ether. $C_2H_5.O.CH_3$. See MIXED ETHERS.

Ethyl Nitrate. $C_2H_5.NO_3$. Bpt. 86° C. Nitric ether. Liquid of agreeable odor and sweet taste, prepared from alcohol and nitric acid in the presence of urea; easily decomposed by alkali forming a nitrate and alcohol.

Ethyl Nitrite. $C_2H_5.NO_2$. Bpt. 18° C. Nitrous ether. Sweet spirits of niter; liquid of ethereal odor and burning taste; prepared by the action of nitrous acid or anhydride upon alcohol. The common sweet spirits of niter is an alcohol solution of ethyl nitrite, used in diazotizing.

Ethyl Oxide. See ETHYL ETHER and ETHER.

Ethyl Sulphate. $(C_2H_5)_2:SO_4$. Bpt. 208° C. Oily liquid of peppermint odor. It gives ethyl ether when warmed with alcohol, and is produced by the neutralization of sulphuric acid by alcohol.

Ethyl Sulphide. $(C_2H_5)_2S$. Bpt. 91° C. Ethylthioether. Liquid with a disagreeable odor, made by treating ethyl chloride with alcoholic potassium sulphide. It forms double compounds with the metallic chlorides: $(C_2H_5)_2S.HgCl_2$.

Ethylsulphuric Acid. $C_2H_5.SO_4.H$. Colorless liquid produced from a mixture of alcohol and sulphuric acid. Its salts are much used for the introduction of the ethyl group in the place of an atom of a metal.

Ethyl Violet. $C_{31}H_{42}N_3Cl$. Hexaethylpararosaniline hydrochloride. Green powder, soluble in water. It dyes wool, silk and cotton mordanted with tannin a brilliant violet.

Etiolin. Yellow coloring matter found in plants grown in the dark or at a low temperature.

Etiology. Causation of a disease. See ÆTIOLOGY.

Etna. Volcano in e. Sicily, 10,874 ft. high. More than 80 eruptions are on record, the last 1874. In 1669 the lava flowed

Etna from the South.

for 40 days, and 10,000 persons are said to have perished.—In Mythology it was the abode of Enceladus and Typhon, and the place of the forges of Vulcan and the Cyclopes.

Eton College. On the Thames, 21 m. w. of London; founded by Henry VI. 1440; one of the chief schools of England, tributary to the universities; governed by a provost and fellows. It has near 1,000 students.

Etretat. Picturesque French watering place on the Norman coast near Havre. Pop., 1891, 2,000.

Etruria. Country in central Italy, w. of the Apennines and n. of the Tiber. Its inhabitants, called Etruscans or Tuscans, and by the Greeks Tyrrhenians, were believed by the ancients to have come from Lydia, by some moderns to have been of Rhætian stock, and by a recent American writer to have been Libyans and akin to the Berbers. They anciently bore sway from the Alps to the Gulf of Sorento, and were strongest ab. 600 B.C. Their government was a close aristocracy. They gave to the Romans many of their religious and political institutions; were conquered by Rome 283 B.C., and received Roman franchise 91 B.C.

Etruscan. Language of ancient Italy, exceedingly difficult to classify. It was assigned by Corssen to the Indo-European family; but this view has met considerable opposition. The material is confined to inscriptions.

Etruscan Art. In the periods known to us, dependent on the Greek, but still distinguishable from it. Large numbers of

Etruscan Mirror from Vulci, with Fufluns (Bacchus), Semla (Semele), and Apulu (Apollo).

Greek works have been found in Etruscan tombs, including the vases sometimes called Etruscan. The Etruscans were expert

engineers and introduced the arch into Italy. Their temples were copies of the Greek, but not so refined in detail or beautiful in proportions. Their tomb-paintings, gem-engraving, jewelry, and bronze utensils, all exhibiting high perfection. The finest Etruscan collections are in the Vatican and in Florence.

Ettingshausen, KONSTANTIN VON, M.D., b. 1826. Prof. of Botany and Mineralogy at Vienna. *Die tertiäre Flora von Häring in Tirol*, 1853.

Ettmüller, ERNST MORITZ LUDWIG. 1802–1877. Prof. Zurich 1833; philologist, who worked in Anglo-Saxon and Germanic languages.

Etty, WILLIAM, 1787–1849. English historical painter, eminent as a colorist and in the nude. He ranks next to Constable and Turner in general distinction for his period.

Etude. In Music, a study or exercise for overcoming special difficulties of technique, or an attempted tone-representation of a certain mood, scene, or sentiment.

Etymology. Science of words, their structure, history, and origin; in this wide sense, the most important part of philology. Its real history begins with that of comparative philology: its results have been of vast importance. It has carried our knowledge of man hundreds of years earlier than any historical records could enlighten us.

Etymology, POPULAR. Popular assimilation of foreign words, *i.e.*, the change of form by which one or more syllables of a strange word are identified with syllables which have a meaning in the vernacular. It is based on resemblance of sounds. The change may (1) be merely in spelling, Fr. *redoute* becomes *redoubt;* or (2) may go further, as Fr. *écrevisse* becomes *crayfish*, or *Chartreuse* becomes *Charter-house.*

Eu, LOUIS PHILIPPE MARIE FERDINAND GASTON D'ORLEANS, COMTE D', b. 1842. Grandson of Louis Philippe; son-in-law of Dom Pedro II. 1864; marshal of Brazil till 1889.

Eubœa. Largest island of the Ægæan; subject to Athens after the Persian wars. Its chief cities were Chalcis and Eretria, colonized by Athenians. It was taken by the Venetians 1351, and called Negropont; was held by Turks 1470–1821, and attached to Greece 1830. Pop., 1889, 103,442.

Eubulides OF MILETUS. Philosopher of the Megaric school ab. 350 B. C. He was bitterly antagonistic to Aristotle, the Stoics and Platonists.

Eucalyptol. Liquid obtained from volatile oil of *Eucalyptus globulus;* used as an expectorant, and in genito-urinary disorders.

Eucalyptus amygdalina.

Eucalyptus. Genus of large forest trees of the Myrtle family, natives of Australasia, commonly known as Blue-gum trees.

Eucharist. Sacrament of the Lord's Supper or Holy Communion, regarded as an especial cause and occasion of thanksgiving; in this aspect viewed as a sacrifice by many who deny it to be propitiatory.

Euchlorine. Greenish-yellow gas, consisting of a mixture of chlorine and chlorine dioxide; made by treating potassium chlorate with hydrochloric acid.

Euchre. Game of cards which has been given a German origin, but probably was due to the French in Louisiana. 32 cards are used, twos to sixes being discarded: Jack of trumps ranks highest, called Right Bower, and Jack of the same color next, called Left Bower; the other cards rank as in whist. Two to four persons may play, in the last case, as partners. Five cards are dealt to each, two and three in sequence, the following card being turned for trumps. In the four-handed game, beginning at the left of the dealer, the players may order the trump card into the dealer's hand or not; in the former case the dealer discards his poorest card, and the playing proceeds. If the dealer also declines the trump, the players in sequence have the option of naming a trump. The score is 2 points for 5 tricks, 1 point for 3 tricks, to the side which names the trump; if this side fail to take 3 tricks they are Euchred and their opponents count 2. A player may play alone and counts 4 points for 5 tricks, 1 point for 3 tricks, and failure to take 3 tricks as before. Five points constitute game. In two-handed game 5 tricks, called March, counts 2, and in three-handed game it counts 3. In Railroad Euchre an additional card, called Joker, is used, which outranks the Right Bower. A player, playing alone, may call for his partner's best card, discarding one, and either opponent may play alone and do likewise; 5 tricks count 4 and 3 tricks to the single opponent counts them 4.

Euclase. $H_2Be_2Al_2Si_2O_{10}$. Hydrous aluminium and beryllium silicate, found in Brazil and in the Ural Mts. It occurs in a great variety of crystalline forms, and is easily cleavable.

Euclid, ab. 300 B.C. Chief of the Greek Geometers. He taught at Alexandria. His *Elements of Geometry*, in 13 books, was in use till recently; his other works are preserved only in fragments.

Euclid OF MEGARA, ab. 400 B.C. Pupil of Socrates; founder of the Megaric school of philosophy, a branch of the Eleatic.

Eucopepoda. Copepods with two or three jointed rami to their swimming feet. They have biting, piercing, or sucking mouth organs. There are two groups, *Gnathostomata* and *Siphonostomata.*

Eucopidæ. See CAMPANULARIDÆ.

Eudemonism. Theory of morality which bases right and wrong upon welfare, and is slightly distinguished from Hedonism in the assumption that the pleasure or happiness represented by welfare is of the intellectual and higher type.

Eudemus. Greek philosopher, disciple of Aristotle.

Eudiometry. Branch of Chemistry dealing with the analysis of mixed gases.

Eudipleura. See DIPLEURA.

Eudocia, or EUDOXIA, ab. 400–460. Wife of Theodosius II. 421; patron of the "Robber Synod" of Ephesus 449; banished ab. 450; author of several works in verse and prose.

Eudoxus, ab. 370 B.C. Greek astronomer, praised by Cicero.

Euechinoidea. See ECHINOIDEA.

Euganoides (GINGLYMODI, BONY GANOIDS). Ganoids with rhomboidal scales, fulcra on the fins, and numerous branchiostegal rays. This includes the Bony Pikes and Gar-Pikes (*Lepidosteus*). The latter have an elongated body, bill-like snout, dorsal-fins placed far back, and heterocercal tail.

Eugene, FRANÇOIS EUGÈNE DE SAVOIE, PRINCE, 1663–1736. General and statesman in Paris; in the service of Austria from 1683; distinguished at the siege of Vienna 1683, at Zenta 1697, and in the war of Spanish Succession. He commanded in Italy

Prince Eugene.

and Holland; shared with Marlborough the glory of Blenheim 1704, Oudenarde 1708, and Malplaquet 1709; defeated the Turks at Peterwardein and Temeswar 1716, and took Belgrade 1717.

Eugenie, MARIA DE MONTIJO DE GUZMAN, COUNTESS OF TEBA, b. 1826. Wife of Napoleon III. 1853.—EUGENE LOUIS JEAN JOSEPH, her son, born March 16, 1856, killed by the Zulus in S. Africa June 1, 1879. She lived at Chislehurst, Eng., after 1870.

Eugenius. Bp. of Toledo 646–657; Latin poet.

Eugenius. I. Pope 654–657. II. 824–827. III. Bernard Paganelli, Pope 1145–53, promoter of the 2d Crusade; thrice expelled from Rome by Arnold of Brescia and the republicans. IV. Gabriele Condolmiere, b. 1383. Pope 1431–47; in conflict with the Council of Basel, which in 1438 elected an antipope, Felix V.

Eugenol. $C_6H_3.C_3H_5.OH.OCH_3$. Bpt. 247.5° C. Oily liquid, decomposing somewhat on distillation. It has a burning, pungent taste and the odor of cloves. It occurs in, and is prepared from, the oil of cloves.

Euglenoidea. Order of Lyssoflagellates, including large monaxonic Flagellates, having a contractile or elastic cortex, so that the shape can be changed, but no pseudopodia are

EUROPE
British Miles
0 100 200 300 400 500
Geographical Miles
0 100 200 300 400 500
Longitude West
0
40
30
20
70
60
50
ATLANTIC OCEAN
BRITISH ISLES
ICELAND
REIKIAVIK
Breidifiord
Holar
Langaness
Husavik
MT. HECLA
FAROE IS.
SHETLAND
ORKNEY IS.
ROCKAL
ST. KILDA
HEBRIDES
C. Wrath
Moray
Inverness
Dundee
EDINBURGH
Glasgow
Malin Hd.
North Chan.
Donegal B.
ACHIL I.
Sligo
Belfast
Galway
DUBLIN
IRELAND
R. Shannon
Limerick
Cork
C. Clear
Irish Sea
Liverpool
Manchester
York
Hull
Newcastle
ENGLAND
WALES
Birmingham
LONDON
St. Georges Channel
Bristol Chan.
Bristol
Plymouth
Portsmouth
Lands End
SCILLY IS.
I. OF WIGHT
Lizard Pt.
English Channel
CHANNEL IS. (Br.)
USHANT I.
Quimper
Brest
Cherbourg
Havre
Dieppe
Rouen
Rennes
Versailles
Nantes
Orleans
R. Loire
Tours
FRANCE
BAY OF BISCAY
La Rochelle
Rochefort
Poitiers
Limoges
Clermont
Bordeaux
MT. D'OR
Aurillac
Agen
Toulouse
Bayonne
Pau
Nismes
Montpellier
R. Garonne
G. of Lyons
C. Ortegal
Corunna
C. Finisterre
Vigo
Oviedo
Santander
Bilbao
S. Sebastian
Leon
Burgos
Vittoria
Valladolid
Oporto
Braganza
Coimbra
PORTUGAL
R. Douro
Torres Vedras
LISBON
R. Tagus
C. Roca
Setubal
Elvas
C. St. Vincent
PYRENEES
MT. MALADETTA
Andorre
Saragossa
R. Ebro
Salamanca
Segovia
MADRID
SPAIN
Guadalaxara
Talavera
Toledo
R. Guadiana
Badajos
Valencia
Cordova
Ciudad Real
Guadalquiver R.
Sevilla
Granada
Murcia
Alicant
Cadiz
C. Maria
C. Trafalgar
Strait of Gibraltar
Malaga
SA. NEVADA
Cartagena
Almeria
C. de Gata
Gibraltar (British)
Tarifa
Ceuta
Tangier
Tetuan
Barcelona
Tarragona
C. Creus
BALEARIC ISLANDS
MINORCA
MAJORCA
IVIÇA
FORMENTERA
MEDITERRANEAN
Oran
Algiers
ALGERIA
MOROCCO
Morrocco
Meridian of Greenwich
AFRICA
G. of Kara
Kara Str.
VAIGATZ I.
Vaigats Str.
Obdorsk
Samoiede
R. Petchora
Usa R.
Petchora R.
Ijima R.
URAL MOUNTAINS
Beresov
R. Obi
KONJAKAVSKI
KATCHKANAR
Tobolsk
R. Irtish
Tobol R.
Ekaterinburg
TAGANAI
IREMEL
Ural R.
Yarensk
Vitchegda R.
Tcherdyn
Solikamsk
Kama R.
Perm
Ustiug
Suchona R.
Nikolsk
Slobodsk
Viatka
Okansk
Sarapul
Viatka R.
Ufa R.
Ufa
R. Unja
R. Vetluga
Kazan
Kama R.
R. Volga
Nijni Novgorod
R. Oka
Simbirsk
Stavropol
Samara
Syzran
Orenburg
Ural R.
RUSSIA
Kozlov
Tambov
Saratov
Uralsk
Voronej
Pavlovsk
Kamishin
Uzen R.
Salt Swamp
Baksaeva
Emba R.
R. Don
Tzaritzin
R. Donetz
Tchirskaya
Sarepta
R. Volga
Astrakhan
Guriev
Dead G.
CASPIAN SEA
N. Tcherkask
Rostov
Taganrog
Azov
Manitch R.
Stavropol
Kuma R.
Georgievsk
Kizlar
Mozdok
R. Terek
Kuban R.
Circassia
Sea of Azof
Str. of Yenikale
M. ELBURZ
M. KAZBEK
CAUCASUS MOUNTS
Takki
Derbend
Karaboghaz G.
C. Apsheron
TCHELEKEN I.
Baku
R. Kur
Tiflis
Georgia
Batoum
SEA
Sinope
Trebizond
Kars
Erivan
MT. ARARAT
R. Aras
Armenia
Minor
R. Euphrates
L. Van
L. Urumiyah
Reshd
PERSIA
ASIA
IN ASIA
Aleppo
SYRIA
Tripoli
Beyrout
Damascus
Acre
Jerusalem
Said

formed. There is usually only one flagellum, and there is a definite pharynx with a contractile vesicle near it.

Eugubine Tables. Seven bronze tablets, bearing inscriptions in Etruscan and Latin; discovered 1444 at Gubbio; pub. 1723 and 1841.

Euhemerism. Theory which traces the persons and events of mythology to human sources; named from Euhemerus of Messene, ab. 300 B.C., and adopted by Polybius and by Christian polemics.

Euisopoda. See ISOPODA.

Eulachon. *Thaleichthys pacificus.* Oily fish allied to smelt, used as a candle by Indians of British Columbia, by drawing a wick through it.

Eulenberg, FRIEDRICH ALBRECHT, GRAF VON, 1815–1881. German negotiator of treaties with Japan and China 1861.

Eulenspiegel, TILL. Hero and title of a humorous romance popular in Germany from 14th century in varying forms; said to be founded on fact.

Euler, LEONHARD. 1707–1783. Swiss mathematician, prof. at St. Petersburg 1733–41; at Berlin 1741–66. "He created analysis, and revised almost all the branches of pure mathematics then known." He devised the forms, in constant use, known as the Beta and the Gamma functions. *Introduction to the Analysis of Infinites,* 1748; *Differential Calculus,* 1755; *Integral Calculus,* 1768–70; *Algebra,* 1770. He wrote also on Astronomy and Physics.

Eumenes, d. 316 B.C. Ruler of Cappadocia and Pontus 323 B.C. He had wars with Antipater and Antigonus, who slew him.

Eumenes II. King of Pergamus 197–159 B.C.; friend of the Romans; founder of a library of 200,000 vols., rivaling that of Alexandria.

Eumenides. Three avenging deities, daughters of Earth or of Night, represented as winged maidens dwelling in the depths of Tartarus, with hair entwined with serpents. Also called Erinyes by the Greeks, and Furies by the Romans.

Eumerogenesis. Production of eumeromorphs.

Eumeromorph. Compound animal or animal colony of zoöid units, which can to some extent exist independently when separated from the parent stock.

Eumolpus. Founder of the Eleusynian mysteries; son of Poseidon.

Eunapius, ab.348–ab.420. Athenian Neoplatonist, author of *Lives of Philosophers.*

Eunomius, d. ab. 393. Bp. of Cyzicus (in n.w. Asia Minor) 360–364; deposed and banished. He taught an extreme variety of Arianism and founded a short-lived sect; condemned 381.

Eunuchs. Chamberlains; usually men unsexed by castration, to be employed in harems. They bore an important part in Oriental society, and sometimes in history. In later days, and especially in Italy, boys were often castrated to preserve their voices for operatic use.

Euonymus. Wahoo, root bark of *E. atropurpureus;* used as mild cathartic.

Eupatoria. Seaport in the Crimea, held 1854–56 by the Allies who repulsed an attack by the Russians Feb. 17, 1855. Pop. ab. 14.000.

Eupatoria: the Harbor.

Eupatorium. Boneset, Thoroughwort, leaves and tops of *E. perfoliatum;* used as a tonic and diaphoretic.

Eupatrides. Athenian patricians, who monopolized the priesthood.

Euphemism. Polite use of indirect expressions to disguise a painful idea or repulsive fact; *e.g.,* in Shakespeare, "convey" for "steal," or at court of Louis XIV. "no more met with," for "dead."

Euphonium. Brass musical instrument of modern invention, the bass of the Saxhorn family. It does not blend well with strings, but is invaluable in the military band.

Euphorbiaceæ. Natural family of flowering plants of the class *Angiospermæ* and sub-class *Dicotyledons,* comprising ab. 212 genera and 3,000 species, widely distributed throughout all parts of the earth, except the Arctic, Antarctic and Alpine regions; called the Spurge family.

Euphorbium. Concrete resinous juice of several species of *Euphorbia;* used as a blistering agent, especially by veterinarians.

Euphrates. River of w. Asia. It rises in the Taurus Mts. of Asia Minor and flows s.e. to the head of the Persian Gulf. Length 1,750 m., drainage area 255,000 sq. m.

Euphrosyne. One of the Graces.

Euphuism. Artificial and pedantic use of language, introduced into England ab. 1560 from Italy or Spain; named from J. Lyly's *Euphues,* 1580; satirized by Shakespeare and Scott.

Euplectella. See HYALOSPONGIA.

Euplexoptera. Earwigs. See DERMATOPTERA.

Eupolis, d. 411 B.C. Greek dramatist, associated with Aristophanes and ranking next to him in comedy; fragments remain.

Eupolyzoa. See POLYZOA.

Euproops. Small Palæozoic king-crab, whose type persists to the present day.

Eur-African Region. Includes Europe and northern Africa. Remains of elephants, the hippopotamus and other African species have been found in Europe. Land connection across the Mediterranean existed until recently, speaking geologically.

Eurasians. Half castes in India: usually children of English fathers and Hindu mothers.

Euripides, 480–406 B.C. Third of the great Attic tragedians. He began his dramatic career at 25 with the *Peliades,* and five times won the first prize at the public contests. He wrote over 90 plays, of which 19 attributed to him have come down entire, besides fragments of others. In the probable order of composition, they are: *Alcestis, Medea, Hippolytus*

Euripides.

Coronifer, Hecuba, Heracleidæ, Suppliants, Ion, Hercules Furens, Andromache, Troades, Electra, Helena, Iphigeneia at Tauri, Orestes, Phœnissæ, Bacchæ, Iphigeneia at Aulis, and *Cyclops.* The *Rhesus* is by some held to be spurious. E., being more liberal than his predecessors, could not believe the old myths, and was called an atheist. In the portraiture of character and expression of emotion he has won the admiration of all ages.

Euroclydon. Term used Acts xxvii. 14, for a great storm in the Mediterranean, believed to be the Hebrew or Phœnician words *ruach* (great) and *gadol* (wind), transferred into the Greek. It was not necessarily a whirlwind, for which the Hebrew *supach* would have been used.

Europa. Daughter of King Agenor of Phœnicia. Zeus, charmed with her beauty, approached her in the form of a bull; she mounted his back, wheron the god rushed into the sea and swam with her to Crete,

Europe. Smallest of the grand divisions of the eastern continent. Its line of separation from Asia is artificial, consisting of the Ural Mts. and River and the Caucasus Mts. It stretches from latitude 35 to 71° N. Its form is very irregular, with numerous great peninsulas and deep bays and arms of the sea. The s. part is mountainous, the principal ranges being the Alps, Balkans, Apennines, and Pyrenees. The n. part is in the main a great plain, rising into mountains only on the Scandinavian peninsula. The area is 3,670,100 sq. m., and the mean elevation but 939 ft., this being the lowest of the grand divisions. Except in the extreme n. part, where the cold is severe, its climates are pleasant and healthful, being much warmer than the same latitudes w. of the Atlantic. The

rainfall is, except in a few limited localities, ample for agriculture and not excessive. The principal rivers are the Rhine, Danube, Don, Dnieper and Volga. E. is occupied almost entirely by enlightened peoples. The principal countries are Great Britain and Ireland, France, Netherlands, Belgium, Norway and Sweden, Denmark, Germany, Russia, Austria-Hungary, Turkey, Italy, Spain, and Portugal. Pop. ab. 360,000,000, or 95 to the sq. m.

Eurybiades. Spartan, who commanded combined Grecian fleet at the battles of Artemisium and Salamis 480 B.C.

Eurydice. Nymph, wife of the poet Orpheus. She died of a serpent's bite; Orpheus followed her to the lower world, and by the charms of his lyre won her back from Pluto, on condition that he should not look back upon her till they had reached the upper world. At the last moment his anxiety caused him to look around, and he saw her caught back to the infernal regions.

Eurylepis. Small, heterocercal lepidoganoid fossil fish, with small fins; found in the Coal Measures.

Eurymedon. River in Pamphylia, Asia Minor, famous for Cimon's victory over the Persians 469 B.C.

Eurypterus. Large crustacean of generalized type, allied to *Limulus* (King Crab); found in the Upper Silurian and Lower Devonian. In the group to which it belongs the crustaceans attained their greatest size. See MEROSTOMATA.

Eurypylous Rhagon. Type of sponge in which the apopyles open directly into the paragastric cavity, without intervention of an aphodus.

Eurystheus. King of Argos and Mycenæ, who imposed on Hercules his twelve grievous labors.

Eurystomata, or EURYSTOMEÆ. See BEROIDÆ.

Eusebius OF NICOMEDIA, d. 342. Supporter of Arius at Nice; patriarch of Constantinople 339; organizer of his party. He baptized Constantine 337.

Eusebius Pamphili, ab. 264–340. Bp. of Cæsarea ab. 314; leader of the semi-Arian party; active at Council of Nice; friend of Constantine. His *Eccl. History* extends to 324, and is of high importance, though far from impartial. His works were collected 1542 and frequently reprinted.

Eustachian Tube. Tube connecting internal ear and throat; discovered by Bartolommeo Eustachio, d. 1574, prof. at Rome.

Eustathius, d. ab. 1190. Abp. of Thessalonica; commentator on Homer.

Eustyle. In Classic Architecture, a term employed to designate a proper proportion of columns to intervals, and sometimes taken to denote an intercolumniation of two and a half diameters. It means, however, "the beautiful" arrangement, and therefore differs according to the order employed and the relation of the diameter of the column to its height.

Eutaw Springs, S.C., BATTLE OF. Sept. 8, 1781, between the Americans, who lost 535, and the British, whose loss was ab. 630.

Eutenia. See WATER SNAKES.

Euterpe. Muse of lyric poetry, daughter of Zeus and Mnemosyne, born in Pieria at the foot of Mount Olympus. The ancient artists always represented her with a flute in her hand.

Euterpe.

Euthanasia. Painless and easy death.

Eutheria. See PLACENTALIA.

Euthyneura. Section of anisopleurous *Gastropoda*, including the *Opisthobranchiata* and *Pulmonata*. In this case the visceral nerves are united below the intestine, not caught in the twist of the latter, and hence are straight and parallel. There is an abortion of the ctenidium and nephridium of the original left side. All the forms are hermaphrodite.

Eutropius, d. ab. 370. Author of a brief history of Rome down to the reign of Valens, in ten books.

Eutychians. Followers of the Constantinopolitan Monophysite abbot Eutyches, condemned 448 and 451.

Eutychianus, ST. Bp. of Rome 275–283, by some accounts. His day is Dec. 7.

Euxine. See BLACK SEA.

Evacuation. Withdrawal from a fortified place, town, or military position, in consequence of a treaty, or from necessity, or in obedience to orders from superior authority.

Evagination. Opposite of Invagination, as when a pouch forms upon a hollow organ by the growing-out of the wall at a certain place.

Evagrius, b. ab. 536. Syrian lawyer and official; author of a Ch. history 431–594.

Evaluation. Finding the value of a function for any specific value of its variable.

Evangelical Alliance. See ALLIANCE.

Evangelical Association. Founded in Pa. 1800, by Jacob Albright, on Methodist principles. It has over 2,000 congregations and ab. 150,000 members.

Evangelical Church. Established in Prussia 1817 by union of Lutherans and Reformed.

Evangelical Church Conference. Meeting of the various Protestant churches of the German States, held every two years at Eisenach. The first conference was held at Berlin 1846.

Evangelical Confederation. Organized 1887 by German Protestants.

Evangelical Counsels. In R. C. Ch., obligatory only on those who voluntarily receive them, as conducive to a higher life; monastic vows of celibacy, poverty, and obedience.

Evangelical Party. Prominent in Ch. of England ab. 1780–1860. Its views were "Low Ch.", generally Calvinistic, and often millenarian.

Evangelical Society. Founded 1830 by French Protestants of the stricter school.

Evangelical Union. Arminian sect founded in Scotland 1843 by James Morrison. It has nearly 100 congregations.

Evangelists. 1. Authors of the four Gospels. 2. Ministers of the gospel who preach it outside of organized congregations.

Evans, AUGUSTA JANE, b. 1836. American novelist. *Inez*, 1856; *Beulah*, 1859; *Macaria*, 1863; *St. Elmo*, 1866; *Vashti*, 1869; *Infelice*, 1875; *At the Mercy of Tiberius*, 1887. She became Mrs. L. M. Wilson, 1868, and lives in Mobile.

Evans, CHRISTMAS, 1766–1838. Welsh Baptist, noted for eloquence.

Evans, FREDERICK WILLIAM, 1808–1893. Leader of the SHAKERS (q.v.) at Mt. Lebanon, N. Y., and writer on their views and usages. *Autobiography*, 1869; *Communism*, 1871–72.

Evans, SIR GEORGE DE LACY, 1787–1870. Irish officer; M.P. 1831–41 and 1846–65; Lieut.-gen. in the Crimea 1854. He served in America 1814–15, and in Spain against the Carlists 1835–37. *Capture of Washington*, 1829.

Evans, HUGH DAVEY, LL.D., 1792–1868. Baltimore lawyer prominent in councils of P. E. Ch. *Md. Common Law Practice*, 1837–67; *Christian Doctrine of Marriage*, 1870.

Evans, MARIAN. See ELIOT, GEORGE.

Evans, OLIVER, 1755–1819. American inventor; he obtained a patent for a steam-wagon 1787, constructed one 1804, and built a high-pressure engine 1802.

Evanson, EDWARD, 1731–1805. Anglican rationalist, tried for heresy 1775. *Dissonance of the Evangelists*, 1792.

Evanston. Town of Cook co., Ill., 12 m. n. of Chicago. Here are the (M. E.) Northwestern Univ. and Garrett Biblical Institute. Pop., 1890, 13,059.

Evansville. City of Vanderburg co., s.w. Indiana, on the Ohio R. It has 3 railroads and considerable manufactures, is supplied with water by the Holly system, and is well sewered. Pop., 1890, 50,756.

Evaporation. Quiet vaporization from the surface of a liquid.

Evarts, WILLIAM MAXWELL, LL.D., b. 1818. U. S. Atty.-gen. 1868–69, Sec. of State 1877–81; U. S. Senator 1885.

Eve. Wife of Adam, and mother of the human race.

Eve, PAUL FITZSIMONS, M.D., 1806–1877. Prof. of Surgery at Nashville from 1850; eminent lithotomist.

Evection. Largest inequality in the moon's motion; discovered by Hipparchus ab. 200 B.C. It is due to the periodic change in the eccentricity of the moon's orbit. This latter is a maximum when the line of apsides is directed toward the sun, and a minimum when it is at right angles to the line joining earth and sun.

Evelyn, JOHN, 1620–1706. .English author, celebrated chiefly for his diary, pub. 1818. Among his other works, *Sculptura*,

John Evelyn.

1662, and *Sylva, or a Discourse of Forest Trees*, 1664, are the most noted.

Evelyn College. Founded 1887 at Princeton, N. J., for the higher education of women; chartered 1889.

Evening Primrose. *Onagra biernis.* Large herb of the natural family *Onagraceæ*, bearing showy yellow flowers which open at dusk; native of N. America; widely cultivated as a garden plant.

Eventognathi (PLECTOSPONDYLI). Group of physostome, fresh-water fishes of small size: with the pelvic fins abdominal in position, with coalesced neck vertebræ and no interclavicles. The principal families included are the *Catostomidæ* (Suckers) and *Cyprinidæ* (Minnows). In both there are no teeth on the jaws, but in the former many, and in the latter few teeth on the pharyngeal bones. Suckers have thick lips, the upper protruding beyond the lower. The length does not exceed 2 ft. Of the Minnows there are nearly 2,000 species, widely distributed. Some of the genera included are represented by Carp, Chub, Dace, Roach, Shiner, and Stone Rollers; in America half the species are Minnows (*Notropis* or *Minnilus*), and exist only east of the Rocky Mts. The males of some species during the breeding season become covered with tubercles, or else brilliantly colored, usually red and silvery. Among the large Cyprinoids is the Carp, which may attain a length of 18 inches. It has a leathery skin and a few scattered large scales. It has been introduced from Europe, and may be raised in ponds in which aquatic plants grow. It is omnivorous.

Everdingen, ALLART VAN, 1621–1675. Dutch landscape painter, second only to Ruysdael, whose master he was. Many of his subjects are Norwegian.—His brother CESAR, 1606–1679, was a gifted artist of the second rank.

Everest, MT. Highest mountain on earth; peak of the Himalayas, in s. Asia; lat. 27° 59′ N.; long. 86° 58′ E. Altitude 29,002 ft.

Everett. Suburb of Boston, Mass., incorporated as a town 1870, and as a city 1893. Pop., 1890, 11,068.

Everett, ALEXANDER HILL, LL.D., 1792–1847. Brother of Edward; Chargé at the Hague 1818–24; Minister to Madrid 1825–29; ed. *North American Review*, 1830–35; Commissioner to China 1845. *Europe*, 1822; *America*, 1827.

Everett, CHARLES CARROLL, D.D., b. 1829. Prof. Bowdoin 1853–59, and Harvard since 1869. *Science of Thought*, 1869; *Fichte's Science of Knowledge*, 1884; *Ethics*, 1891.

Everett, EDWARD, D.C.L., LL.D., 1794–1865. Prof. Harvard 1815–25; ed. *North American Review* 1820–24; M.C. 1825–35; Gov. of Mass. 1835–39; Minister to England 1841–45; Pres. Harvard 1846–49; U. S. Sec. of State 1852–53; U. S. Senator 1853–54; candidate for Vice.-Pres. 1860; famous as an orator. He pub. *Orations and Speeches*, 1836–59, besides several poems, and edited D. Webster's *Works*, 1852.—His son WILLIAM, Ph.D., b. 1839, prof. Harvard 1872–77, M. C. 1893, is a prominent reformer. *On the Cam*, 1865.

Everglades. Large marsh in s. Florida, occupied by Seminoles.

Evergreens. Plants with persistent leaves, as the Holly, Pine, Spruce.

Everlasting. Various species of the genera *Antennaria*, *Anaphalis*, *Gnaphalium*, and others, plants of the Composite family, of wide geographical distribution.

Everlasting Flower (*Helichrysum bracteatum*).

Evertebrata. See INVERTEBRATA.

Evesham. Borough of Worcestershire, where Simon de Montfort was defeated and slain 1285, breaking the combination of the barons. Pop., 1891, 5,836.

Eviction. Depriving one of the possession of land by actual expulsion, or by substantially impairing his enjoyment so that he voluntarily withdraws.

Evidence. "Means, sanctioned by law, of ascertaining in a judicial proceeding the truth respecting a question of fact." English law generally requires oral evidence to be given under the sanction of an oath; requires it to be relevant to the issue in the case, and prohibits hearsay evidence.—In philosophy, ground of belief, consisting either of facts or of proof of the deductive kind.

Evidences of Christianity. Urged from the beginning against objections; divided into external, prophecy, miracles, and the genuineness and authenticity of the N. T. books, as attested by historical testimonies; and internal, fitness of the Gospel teachings to promote human virtue and happiness, and fact that they have done so, as shown by the results. Paley's famous work, 1794, laid main stress on the former: of late years the latter are chiefly relied upon. Evidences form a department of theology, Apologetics.

Evil. Opposite of good, physically and morally. Its origin, presence, and prevalence, in the forms of disease, suffering, and sin, have always perplexed earnest minds, and still present an insoluble problem, despite countless efforts to explain them. The Gnostics and their successors held the theory of dualism. Others hold that evil is necessary as a foil to good, and implied by free will.

Evil Eye. Belief in the power of the eye to exert an evil influence or fascination is almost universal among primitive people, and has descended to our own times both in Europe and the East. It is commonly thought that the spell may be averted by counter-charms, for which purpose a great variety of amulets are worn, especially in s. Italy, where the Jettatura, as it is called, is regarded as a danger from which none are exempt. Representations of a phallus, or objects simulating it, such as the teeth and horns of animals, hands with one or more fingers extended, or fragments of pucious coral, are carried as a protection against it. A remarkable parallel in the notions about the eye exists between the current beliefs in China and those of the aboriginal people of America.

Evolute OF A CURVE. Locus of its centers of curvature.

Evolution. That living organisms originated by a mechanical process from earth or water, and that higher forms arose by transformation of lower ones was taught by the Greeks 500 B.C.; also by Aristotle, who was authority for 2,000 years. In the 17th century began the struggle between the theories of Special Creation and Evolution, the former supported by the school of Cuvier, the latter by Goethe, Buffon, Lamarck, etc.; but not till Darwin and Wallace (1859) published the theory that a new species could originate from an existing species by the natural selection, or superior survival of such of the offspring as do vary from their parents in ways better adapting them to their environment, did naturalists generally accept the doctrine of evolution. The method of evolution is in important details still under dispute. Weismann holds that variation is fortuitous and only the changes of germ cells, and not the characters acquired by the body, are hereditary, while the neo-Lamarckians think that the strain on organs not adapted in some way produces directly advantageous variations that are transmitted. Pasteur and Tyndall have shown that living matter always originates from living parents. Most biologists think this biogenetic law could not have held true "in the beginning." See DARWINISM.

Evolution. In Mathematics, process of extracting roots.

Evolution OF THE EARTH. Modern Geology regards the earth as it now exists as the outcome of a long series of processes, the tracing of which is the ultimate and highest aim of the science. Evolution teaches that the globe was originally part of a vast mass of nebulous matter, from which, by the action of inherent laws, have been slowly developed the spheres of which the solar system consists. These at their first condensation existed as globes of liquid matter, resembling furnace slag. By subsequent cooling they have since become more or less solid, but most of them, the earth included, probably retain some of their original fluidity. A high internal temperature is indicated in the case of the earth by the phenomena of wells and deep borings, which are always warmer at the bottom than at the top.

The earth was formerly regarded as a shell of solid matter surrounding a liquid core. Afterward the theory was advanced that the whole globe was solid. But the conception that best explains the phenomena manifested at the surface is that the central part is solid in consequence of the pressure of the masses above it at a temperature as high as is consistent with solidity, and that the surface is solidified by cold, while between these exists a liquid, or at least a viscous layer, perhaps of no great thickness.

The development of the earth has been practically a long process of slow refrigeration, which still continues; to this cooling and the necessary contraction that follows it are due many of the superficial features of the globe.

The outer crust, long cold and hard, is unable to yield as the internal portion becomes colder and shrinks. It is consequently crumpled into folds and flexures, as the skin of an orange or apple when the fruit dries. To this cause many geologists ascribe the origin of those anticlinal axes out of which by subsequent erosion our mountains have been sculptured. (See OROGRAPHY.) Another party maintains that this cause is insufficient, and that some other must exist that will afford a greater amount of shrinkage, such as the extrusion of matter by volcanoes. In either case there can be no doubt that the earth is now much smaller than it once was, evidence of immense contraction existing at the surface.

The history of our globe consists therefore of a long and distant past, during which it was untenanted on account of the heat; a time when life became possible and actual, the present; and a long and distant future when, owing to refrigeration and the consequent absorption of the air and the water by the cooled crust, life will become again impossible. As the first of these three stages seems to be represented by the planets Jupiter, Saturn and the Sun, which are still luminous, so the last is apparently foreshadowed by the Moon, which is seemingly cold and lifeless, without air and water.

Evolutions. Military movements or maneuvers by which bodies of troops pass from one formation to another.

Evora. Ancient city of Portugal, 72 m. e. of Lisbon; taken by Romans 80 B.C., by Moors 715, and by Christians 1139; noted for its aqueduct, temple, tower, and other antiquities. Pop. ab. 14,000.

Evremond, CHARLES. See SAINT-EVREMOND.

Evreux. Town of France, 67 m. w.n.w. of Paris; sacked

Evreux.

by Northmen 892, burned by English 1119. In the vicinity are Roman ruins.

Ewald, GEORG HEINRICH AUGUST, 1803–1875. German Orientalist: Prof. at Göttingen 1827–37 and 1848–67, and at Tübingen 1838–48. He pub. two Hebrew Grammars 1827–42; commentaries on the *Poetical Books of O. T.*, 3 vols., 1835–39, and on the *Prophets*, 3 vols., 1840–41; a *History of Israel*, 7 vols., 1843–59; *Antiquities of Israel*, 1848, and other books, most of which have been translated. His learning and influence were immense.

Ewald, HERMAN FREDERIK, b. 1821. Danish novelist. *Waldemar Krone's Youth*, 1860; *Agathe*, 1873; *Griffenfeld*, 1888.

Ewald, JOHANNES, 1743–1781. Danish lyric poet and dramatist. *Rolf Krage*, 1770; *Balder's Death*, 1773; *Rungsted*, 1776; *The Fishers*, 1780, contains two famous songs. His works were collected 1792, and repub. in 8 vols. 1850–55.

Ewell, BENJAMIN STODDERT, LL.D., b. 1810. Prof. Math. at West Point 1832–35, at Hampden-Sidney College 1840–46, at Washington College, Va., 1846–48, and at William and Mary 1848; pres. of the latter 1854–61 and 1865–88.—His brother, RICHARD STODDERT, 1817–1872, Lieut.-gen. C. S. A., 1863–65, was prominent at Winchester, Gettysburg, and the Wilderness.

Ewer. Water vessel with base, spout, and handle, usually accompanying a wash-basin. The ewry was an ancient office in the royal household where the table linen and ewers were deposited.

Ewer, Palissy ware.

Ewing, FINIS, 1773–1841. Founder of the Cumberland Presbyterian Ch. in Ky. 1810.

Ewing, JAMES ALFRED, F.R.S., b. 1855. Prof. of Engineering at Tokio, Japan, 1878–83, and since in Japan. *Magnetic Induction*, 1892.

Ewing, MRS. JULIANA HORATIA ORR (GATTY), 1842–1885. English author of *Jackanapes*, *Lob-lie-by-the-fire*, and other admirable tales for children. See GATTY.

Ewing, THOMAS, LL.D., 1789–1871. U. S. Senator from Ohio 1831–37 and 1850–51; Sec. Treasury 1841; Sec. Interior 1849–50.—Of his sons, HUGH BOYLE, b. 1826, Minister to Holland 1866–70, and THOMAS, 1829–1896, M. C. 1877–81, were generals of U. S. Vols. 1863–65.

Exactions. Money or goods unlawfully extorted by the clergy of old; forbidden by several Popes and Councils.

Exalbuminous. Seeds without albumen.

Exalgine. See METHYL ACETANILIDE.

Examiner. Periodical conducted by Dean Swift 1710–11 in the Tory interest. Prior contributed to it.

Exanthemata. Diseases characterized by an eruption.

Exarch. Viceroy of the Byzantine emperors, at Ravenna 554–752, and elsewhere. In the Eastern Ch., a patriarch's deputy.

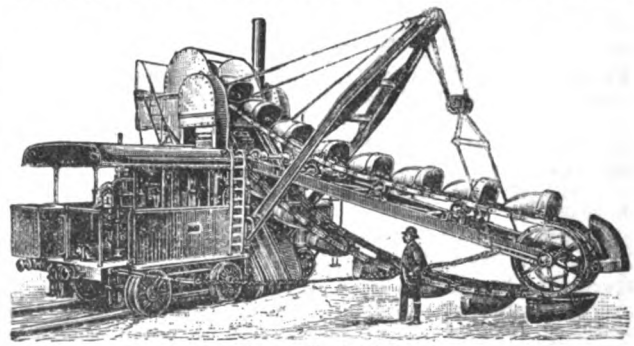
Excalibur. Sword of the mythical King Arthur.

Excambion. Scottish contract for exchange of lands.

Ex Cathedra. Authoritative decision, originally papal.

Excavation. Cut in the earth, having definitely formed sides; constructed for a useful purpose, as for the passage of a railroad through a hill, or for a canal. The cost of excavation, not including haulage of the material, ranges from 5 to 20 cents per cubic yard for common earth, and for rock ab. five times as much.

Excavator. Machine like a steam-shovel, for excavating



Steam Excavator.

earth. A dredge is for the removal of earth which lies under water.

Excellency. Title formerly of princes, now of ambassadors and some governors.

Excess, SPHERICAL. Amount by which the sum of the angles of a spherical polygon exceeds two right angles multiplied by the number of sides less 2.

Exchange. Cost in one country or town of replacing a given amount of money in another.—In Economics, group of processes in which one commodity is given for another. Its study occupies a considerable part of the science of political economy, and involves all questions of value, of money, of credit, and of foreign trade.

Exchange, Bills of. Invented by Jews 1160 to remove their property from persecuting countries; used in England 1307.

Exchange, Rate of. Premium or discount which has to be paid for bills of exchange from one country on another. Its amount is limited by the cost of transmitting specie in payment of the balances owing, and the insurance on this during its transmission.

Exchangeable Goods. Such commodities as are transferable and also limited in quantity, and therefore possessed of exchange value.

Exchange Value. Amount of any one thing which at any particular time and place can be obtained for a given amount of another. This second object, in which the exchange value of the first is expressed, is generally money, and its exchange value is then known as its price.

Exchequer, Court of. Superior English common law court, instituted ab. 1709 to recover debts due the Treasury. It took its name from the chequered cloth of the judges' table, and was a separate court after Henry III. Its jurisdiction gradually included common pleas and equity; its equity jurisdiction was abolished 1841. It was incorporated as a separate division with the High Court of Justice 1873, and in 1881 merged in the Queen's Bench division.

Exchequer Bills. Negotiable securities with interest coupons, issued by the British Exchequer, or treasury department, under statutory authority.

Exciple. Membrane which incloses the apothecium of Lichens.

Excise. Internal tax, levied on the production, sale, or consumption of certain commodities.

Excise Laws. Those taxing and regulating the consumption of domestic commodities; frequently applied to statutes governing the liquor traffic.

Excito-Motor Action. See Reflex Action.

Exclusion Bill. Passed by the Commons but thrown out by the Lords 1679. Its purpose was to exclude the Duke of York from the throne because he belonged to the Church of Rome.

Excommunication. Exclusion from the Eucharist. In R. C. Ch., distinguished into Greater and Lesser, the former marking the culprit as to be avoided, and inflicted only by the higher authorities. Its use is chiefly in the past.

Excretion. Process by which waste products of the system are prepared for discharge from the body; or, the product itself.

Execution. Judicial process for carrying into effect a judgment, generally by seizing property or arresting a person. —In Criminal Law, capital punishment, formerly by various modes, now usually by Hanging, Decapitation, Shooting, or Electrocution (q.v.). See also Capital Punishment.

Executive. Branch of government which enforces the laws; in the U. S., the President, his cabinet, and their subordinates; in the States, Governors and those under them.

Executor. One named in a will to carry out its provisions. If one interferes with a decedent's goods without authority, he is called executor *de son tort*—of his own wrong.

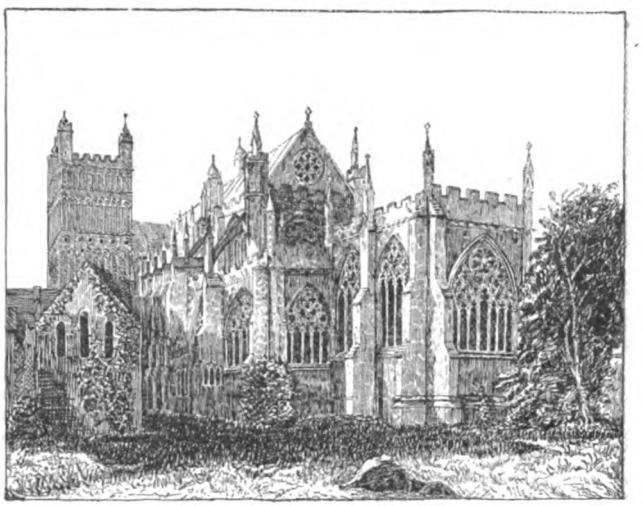
Exegesis. Department of theology which includes determination of texts, elucidation of their meaning, and everything else pertaining to the Scriptures. It has always been cultivated more or less by Jews and Christians, and of late has greatly increased in range of effort and value of results.

Exelmans, Remi Joseph Isidore, Comte, 1775–1852. French general, banished 1815–23; marshal 1851.

Exempla Books. Mediæval collections of stories used principally by Franciscan and Dominican preachers at the end of the sermon to illustrate and point the moral. They were very popular from the 12th century to the invention of printing.

Exercise. Systematic employment of the muscles: more broadly, the voluntary use of any faculty or function. During exercise exhalation of carbonic acid is augmented, the excretion of urea increased and the temperature of the body elevated. A walk of from three to five miles represents minimum amount of exercise necessary for those leading sedentary lives, which may be increased to twenty miles (at the rate of about three miles per hour), in the more active.

Exeter. Ancient city of Devonshire, on the Exeter, 10 m. above its mouth; taken by Danes 876 and 1003. It contains a



Exeter Cathedral.

celebrated cathedral, begun 1112, and some Roman remains. Pop., 1891, 37,580.

Exeter Hall. Building on the Strand, London, finished 1831. It seats above 5,000 persons, is used for musical and religious assemblies, and was bought by the Y. M. C. A. in 1880.

Exfoliation. Flaking off of bark in certain trees.—Also the casting off of a mass of tissue or bone after the death of the tissue or bone.

Exhalation. Giving off vapor or gas.

Exile. Expulsion from one's native land, enforced residence abroad. Among the Romans it was an interdiction from fire and water, which forced the offender to leave the country since he could not exist without them. To the Greeks and Romans exile was the worst of all punishments.

Existence. Fundamental attribute of all being except when it is used to denote all that is. To have existence, however, is to be real and to persist in time.

Exmoor. Wild region in Somersetshire and Devonshire, partly wooded, mostly hills and commons, little cultivated; celebrated in Blackmore's *Lorna Doone*. Area near 20,000 acres. See Horse.

Exmouth, Edward Pellew, 1757–1833. British Admiral 1804; Knight 1793, Baronet 1796, Baron 1814, Viscount 1816 for bombarding Algiers and enforcing the treaty which abolished Christian slavery there.

Exner, Franz, 1802–1853. Prof. Prague 1831. *Psychology of Hegel*, 1842.

Exocarp. Outer layer of the Pericarp or seed vessel.

Exoccipital. Bone bounding the foramen magnum laterally; not a distinct bone in man.

Exocœtus. See Anacanthini.

Exocyclica, or Irregularia. Sea Urchins more or less flattened, with the anus outside the genital area and near the margin of the disk; the ambulacral zones are petaloid. There are two groups, *Clypeastroidea* and *Spatangoidea*.

Exodus. Second O. T. book, describing the removal of the Israelites from Egypt. Its Mosaic authorship has been disputed.

Exogamy. Custom among certain races of man by which intermarriage within the same tribe or clan is prohibited.

Exogenous. Vegetable stem which increases in diameter by the periodical formation of a new layer of tissue between the older wood and the bark, consisting of a central pith, one or more layers of wood, and an exterior bark, itself composed of several different layers. The wood is traversed from center

to circumference by plates of parenchymatous tissue, the Medullary Rays.

Transverse section of the trunk of a Fir-tree.

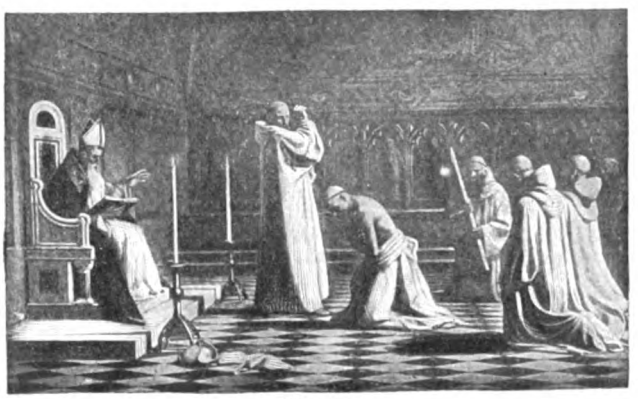
Exogens. See DICOTYLEDONS.

Exophthalmic Goitre. Nervous disease, with high mortality, most common among women; characterized by protrusion of the eyes, increased action of the heart, anæmia, and enlargement of the thyroid gland. It is usually chronic, and is best treated by galvanism and measures to restore the general health.

Exophthalmos. Condition in which the eye protrudes more than is natural from its socket.

Exopodite. Outer of two appendages borne by the protopodite of crayfishes; not present on the walking-legs.

Exorcist. One who adjures an evil spirit to leave the body of a possessed person; in the early Ch., an order of the ministry,



Exorcism.

still subsisting, but only nominally, in R. C. Ch. Exorcism, when now performed at baptism, or otherwise, is commonly a function of the priest.

Exoskeleton. Outer, shell-like skeleton; ossifications or cornifications occurring in the skin, hence either epidermal, dermal, or both. The skeleton of Arthropods is of this sort, as are the scales and plates of Vertebrates. Hoofs and nails are the relics left in mammals of this sort of skeleton. See DERMOSKELETON.

Exosmosis. Passage of a fluid through an animal membrane outward from vessel or cavity in which it is contained, as transudation of fluid part of the blood through wall of vessels. See OSMOSE.

Exospore. Outer cell-wall of spores of ferns, etc.

Exosporea. Order of *Mycetozoa*, in which the spores hatch as amœbulæ, become flagellulæ, and return to the amœboid state to form the plasmodium. The fruit is in the form of conidiospores.

Exostome. Orifice through the outer coat or Primine of the ovule forming the outer part of the foramen or micropyle.

Exostosis. Abnormal outgrowth from a bone.

Exoteric. Phenomena arising outside of an organism. See ESOTERIC.

Exothecium. Outer layers of cells of the anther-sac.

Exothermal Reaction. See ENDOTHERMAL REACTION.

Exotic. Plants or animals not indigenous to a country.

Expansion. Development, as limited to the performance of indicated operations.

Expansion of Rails. Under a change of 100 degrees in temperature a steel rail 30 ft. long expands ab. ¼ inch. If this expansion be prevented, compressive stresses arise, which often cause rails to spring out of the track. For this reason rails laid in cold weather should have spaces between the joints of ab. ¼ inch.

Expansion of Solids by Heat. Experiment has shown that all bodies increase in size by heat; the increase in volume for each degree of the thermometer scale for each substance has been called its coefficient of expansion. The linear coefficients of some of the usual solids are, between 0° and 100° on the Centigrade scale:

Glass	0.000008613	Bronze	0.000018167
Platinum	0.000008842	Brass	0.000018782
Steel	0.000010788	Silver	0.000019097
Cast Iron	0.000011250	Tin	0.000021730
Wrought Iron	0.000012204	Lead	0.000028575
Gold	0.000014660	Zinc	0.000029417
Copper	0.000017182		

The coefficients of cubical expansion are obtained by multiplying the linear coefficients by 3. See COEFFICIENT OF EXPANSION.

Expansion Rollers. Rollers placed under one end of a bridge to allow it to expand or contract as the temperature rises or falls, and thus prevent the occurrence of temperature stresses.

Expansive Force of Steam. A given volume of steam in a closed vessel exerts a pressure in every direction directly proportional to its absolute temperature. When this volume is increased, the temperature falls, and vice versa. The expansive force of the vapor varies with the volume according to a law which is represented graphically by a curve of the hyperbolic class. If there is a source of heat to make good any demands for it, so that the pressures can be exactly inversely as the volumes, the curve is an equilateral hyperbola. Other curves are the adiabatic, the isodynamic and the isothermal. By working the steam expansively in the steam engine it is rejected from the apparatus at a much lower temperature, and hence the fuel-heat, for which it is a vehicle, is more thoroughly utilized. A conception of the expansive force of steam may be thus formed. If a piston without weight of one square foot of area be conceived as fitting a cylinder whose bottom contains a cubic foot of water, tables of steam volumes will show that for a pressure of 100 lbs. to the sq. inch that piston will stand at a height of 271 feet. Hence a cubic foot of confined water at 100 lbs. pressure can do a work corresponding to 144x100x271=3,902,400 foot pounds.

Expansive Force of Water. Water is practically incompressible, and by filling a closed vessel full to the exclusion of air and applying heat, a great internal pressure is produced. In passing from 60° to 212° F. water increases its volume by $\frac{1}{24}$. After 212° steam forms and the increase of volume is of no value. This principle has been used to test the strength of steam-boilers to resist internal pressure.

Expatriation. Renunciation of one's native or adopted country, and transfer of allegiance to another.

Expectorants. Remedies which promote the expulsion from the lungs of mucus.

Expediency. Utility; property of serving personal or public interest; appealed to for the support of a policy when no other reason can be assigned.—In Ethics, principle which rejects any supreme rule of action, or absolute right and wrong, and weighs all moral action by the character of the object which it promotes.

Expense Magazines. To avoid the disastrous results attending the explosion of great quantities of powder, and consequent destruction of shot and shell, small magazines are constructed near the batteries for their immediate service. These can then be supplied from time to time from the main magazine, located in more secure positions near at hand.

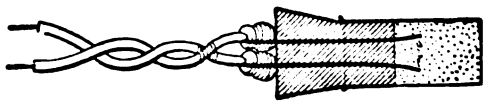
Expenses of Production. See COST OF PRODUCTION.

Experience. 1. Occurrence of an event in a subject whether conscious or not. 2. Occurrence of any individual conscious event in a subject, as a sensation or thought. 3. Connected series of conscious events, giving rise in the end to some fact or knowledge not contained in the individual events, as such, making the series. The various theories of knowledge and morality are much confused by the equivocation incident to this variety of meanings.

Experimental Psychology. See PSYCHOLOGY.

Expert. One who is recognized to possess special knowledge in a particular subject, and whose testimony is therefore of special value.

Exploder. Small copper cap, containing fulminate of



Exploder.

mercury or other detonating compound, used in firing charges of nitroglycerine, dynamite, and similar explosive compounds.

Exploitation. Process of working a mine after the productive period has been reached.

Explosions of Steam-Boilers. The ordinary explosion follows from a sudden release of the vapor pressure which keeps the highly heated water in the closed vessel from becoming steam. This release of pressure is usually due to a rupture because the shell had been too weak at some point to resist the internal pressure. This weakness may have resulted from bad original design, or from deterioration in use. The pressure being released from the water, which contains much more heat than is required to make steam at the lower pressure (see BOILING-POINT OF WATER), the water boils and becomes steam with a rapidity and an increase of volume easily comparable to the parallel action of ignited gunpowder, and the shell, already weakened by the initial rupture, is further torn, and is projected by the reaction of the water and the expanding steam-gas to considerable distances. The extent of the disaster depends upon the size of the opening and rapidity of the release of pressure. Where but a small outlet makes the release gradual, there will be no projection. This is an element of safety in sectional boilers.

Explosive Gelatine. Usually nitroglycerine with nitrocellulose dissolved in it. Camphor is often added. See GELATINE-DYNAMITE.

Explosives. Unstable chemical compounds or mixtures, some solid and some liquid, which, under certain conditions easily attained in practice, are converted with great rapidity into a mixture of gases, which, by their great volume and high temperature, exert an enormous pressure on surfaces exposed to their action. The effect produced depends on the composition and condition of the explosive, the total amount of gas generated, and the rate of generation. Where the gas is formed slowly, as with gunpowder, an explosion is the result of gradually increasing pressure; where the change to a gas is instantaneous, as with nitroglycerine, there is a detonation that acts like a sharp blow. The former is called a low explosive and the latter a high explosive. The explosives commonly used will be found described under their several titles. Of the nitrate mixtures, gunpowder for firearms, and soda powders for blasting are most common. Rack-a-Rock for blasting and Angendre's powder for firearms, both potassium chlorate mixtures, have been used. Of the nitro compounds, nitrocellulose, nitroglycerine and picric acid and their mixtures with other substances, have come largely into use for high explosives and smokeless powders, both for firearms and for blasting purposes. Of the first named, there are included gun cotton and Schultz's powder; of nitroglycerine mixtures there are dualine, lithofracteur, dynamite and giant-powder. Mixtures of nitroglycerine and gun cotton are gelatine-dynamite and forcite. Nitrobenzene mixtures have also been used. The picrates have been used for shells and smokeless powders, as in Mellenite, Sprengel's powder and Vielle's powder. The fulminates are only used in detonating exploders, in the form of caps in firearms and in blasting, being exploded either by percussion or electricity.

Exponent. This symbol, originally confined to indicating "power," is now placed above and at the right of a quantity to indicate either power, or root, or both, as the exponent is either integral or fractional. Like quantities are multiplied by adding and divided by subtracting their exponents. A negative exponent therefore indicates that its base is a divisor. A quantity is raised to any power (integral or fractional) by multiplying its exponent by the index of the power.

Exponential Equations. Those in which the unknown or variable is an exponent. The simple forms are solved by taking the logarithms of both members.

Exponential Function. One in which the variable is involved as an exponent.

Exponential Sines. Development of an exponential function.

$$a^x = 1+(\log a)x+(\log a)^2\frac{x^2}{\lfloor 2}+(\log a)^3\frac{x^3}{\lfloor 3}+\ldots\ldots$$

Exports. Commodities sent out of a country for sale in some other.

Expositions, INTERNATIONAL. 1. At London 1851. It lasted 144 days; the buildings and grounds covered 21 acres. There were 17,000 exhibitors and 6,039,195 visitors. The receipts were $2,530,000, and the expenses $1,460,000.

2. At Paris 1855. It covered 24½ acres, and continued 200 days; there were 21,779 exhibitors and 5,162,230 visitors. The cost is estimated at $1,700,000; the receipts were $1,280,000.

3. At London 1862. It covered 23½ acres, and continued 171 days; there were 28,653 exhibitors and 6,211,103 visitors. The cost was $2,300,000 and the receipts $2,040,000.

4. At Paris 1867, covering 37 acres. It lasted 217 days; the number of exhibitors was 50,236, and of visitors 10,200,000. The cost was ab. $4,000,000, the receipts $2,100,000.

5. At Vienna 1873. It had 40 acres covered with buildings, lasted 186 days, had 42,000 exhibitors, and 7,254,687 visitors. The cost was ab. $11,000,000, the receipts $1,030,000.

6. Centennial Exposition at Philadelphia 1876. The buildings covered 60 acres; it was open 159 days. There were ab. 60,000 exhibitors and 9,910,996 visitors. The cost is estimated at $8,500,000, the receipts were ab. $3,800,000.

7. At Paris 1878. The buildings covered 60 acres, it was open 194 days. The number of exhibitors was ab. 32,000, that of visitors ab. 13,000,000. The cost was ab. $9,000,000, the receipts nearly as large.

8. At Paris 1889. The buildings covered 75 acres, it was open 184 days. There were ab. 60,000 exhibitors, and 32,354,111 visitors. The cost was ab. $11,000,000, the receipts were $8,380,000.

9. The largest was the World's COLUMBIAN EXPOSITION (q.v.).

10. At Antwerp 1894. The buildings covered 25 acres.

Ex post facto. Law operating retroactively. The U. S. Constitution prohibits penal legislation of this kind, *i.e.*, a law rendering an act punishable in a manner in which it was not punishable when done.

Exposure. In Geology, place where any stratum can be seen on the surface.

Express Companies. Business corporations for the forwarding of merchandise. The credit of being first in this enterprise is given to W. F. Harnden, who carried packages from Boston to New York in 1839. Adams Express Co. was started 1849, Wells, Fargo & Co. 1852, and the American-European Co. 1855.

Exsiccata. Dried herbarium specimens, especially such as are distributed in sets.

Exstipulate. Leaves destitute of stipules.

Extension. Property of matter in virtue of which it occupies space. The amount of extension or volume of a body is the numerical measure of the space it occupies. Its dimensions are given by the equation,

$$[V]=[L]^3.$$

Extension. Movement which places two members of a limb in a straight line. An Extensor is a muscle having that effect.

Extensive Agriculture. System of farming in which cultivation is given to an extent of land large relatively to the amount of labor and capital employed.

Extenuating Circumstances. Considerations which tend to mitigate the punishment of a crime; *e.g.*, youth, insanity, former good character, outside influence, or provocation.

Exterior Angle OF A POLYGON. That included between any side of a polygon and the adjacent side extended.

Exterior Angles IN PARALLELS. Two parallels being cut by a transversal, the angles without the parallels on the same side of the transversal are exterior angles on the same side; those without on opposite sides of the transversal are alternate exterior angles.

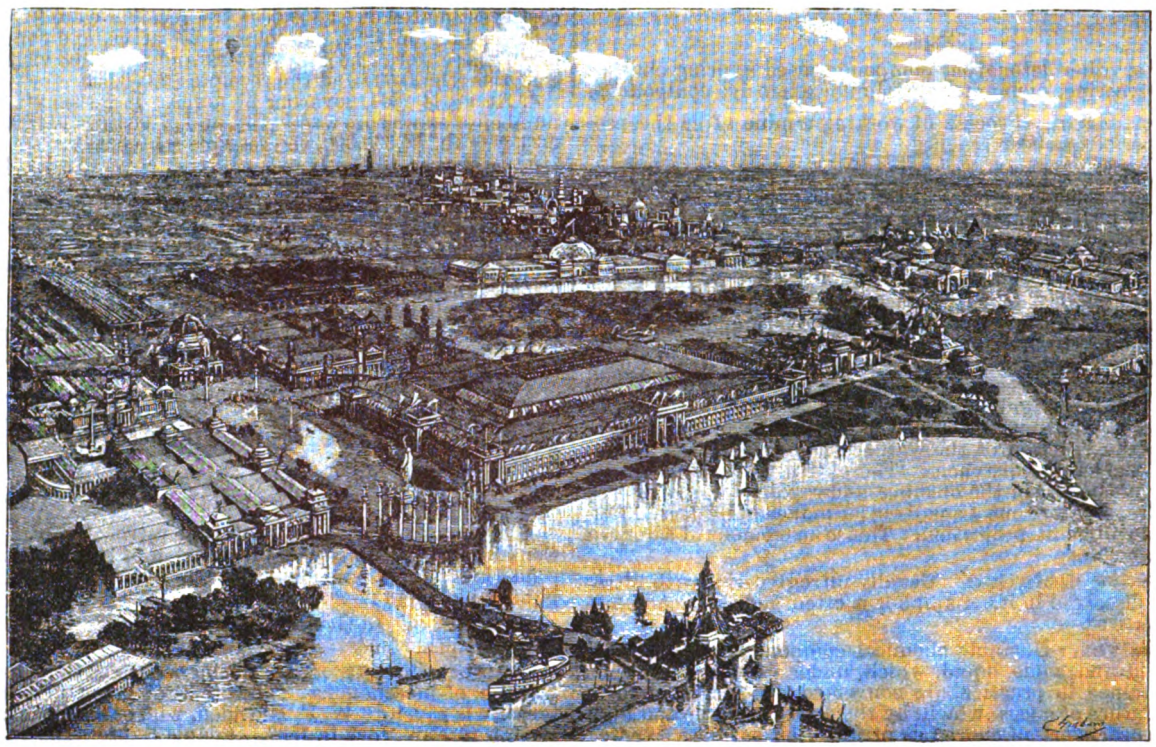
Exterior Crest. Intersection of the planes of the superior and exterior slopes of a parapet.

Exterior Defenses. Detached works constructed for the defense of a position and not immediately connected with the main work.

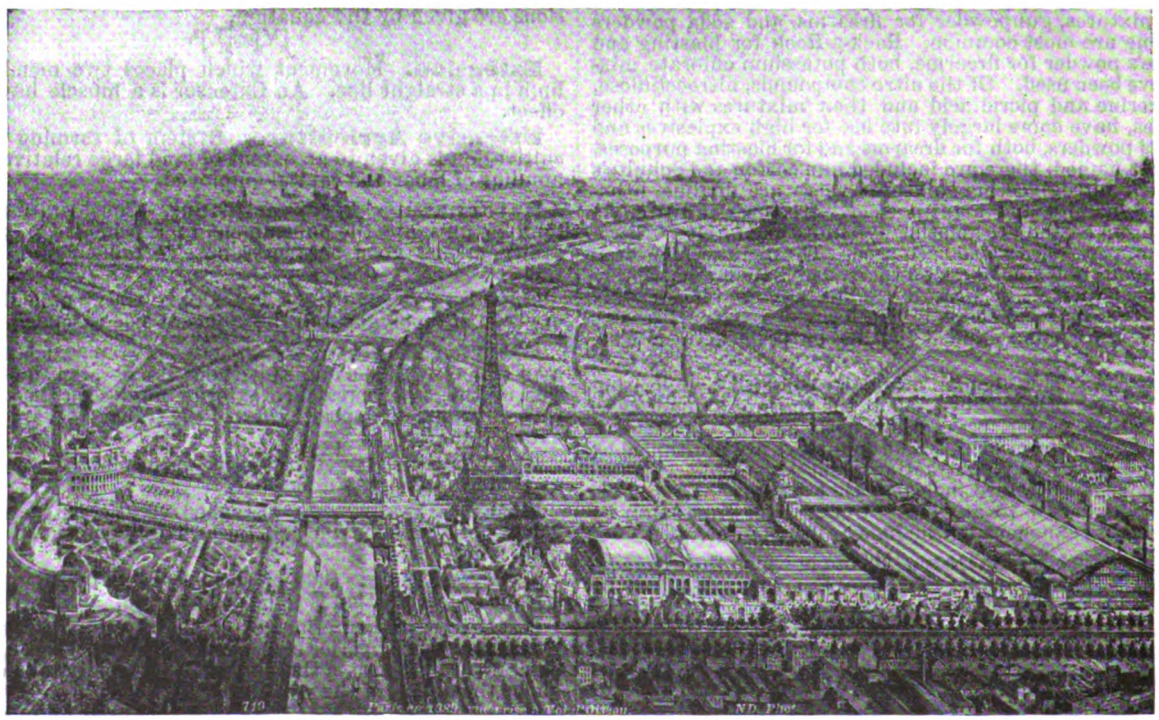
Exterior Side. Side of the polygonal figure upon which a front of fortification is to be constructed.

Exterior Slope. Surface of that portion of the parapet which joins the superior slope with the scarp wall of the parapet. In ordinary cases this slope is that usually taken by earth under the action of the weather or ab. 45°.

External Economics IN THE INCREASE OF PRODUCTION. Those economics or increased facilities for rapid production of wealth which arise from general development of industry, increase of the wealth, numbers, and intelligence of the people, growth of correlated branches of industry, and concentration of such industries in the same localities.



WORLD'S COLUMBIAN EXPOSITION AT CHICAGO, 1893.



INTERNATIONAL EXPOSITION AT PARIS, 1889.

Externality. That which is outside of consciousness, containing an independent existence, not dependent upon an act of mind.

External Nares. See NARES.

Exterritoriality. Jurisdiction of a State over certain classes of persons or property beyond its territorial limits; *e.g.*, sovereigns, public armed vessels and their crews, armies in transit, and national representatives.

Extinction of Species. Disappearance of a species from the earth, either in consequence of being crowded out in the struggle for existence, or of being so modified as to become a new species. The duration of specific life is various, but as a rule, marine species endure longer than terrestrial, and low forms longer than higher.

Extine. Outer coat or cell-wall of a pollen grain.

Extortion. Unlawful taking of any valuable thing by a public officer, by color of his office.

Extraction OF THE ROOTS OF NUMBERS. Any root of a number may be obtained approximately by dividing the logarithm of the number by the index of the root. The number corresponding to the quotient logarithm will be the root required.

Extracts. In Chemistry, the residuum of the evaporation of aqueous decoctions or infusions of vegetable matter. In Medicine and Pharmacy, the various preparations obtained by evaporating the expressed juices or the decoctions, infusions, or tinctures of vegetable substances until a mass of a solid or semi-solid consistence is formed. They vary in nature and composition with the substances from which they are prepared and the fluids used as solvents. They are termed watery, alcoholic, acetous, or ethereal according to the menstruum employed. The object is to preserve the principles from putrefaction. Compound extracts are those which are prepared from several plants and simple extracts from one only. Fluid extracts are only evaporated to a thin syrup and then mixed with $\frac{1}{10}$ to $\frac{1}{8}$ of their volume of rectified spirit.

Extracts OF MEAT. Fluid, semi-fluid, or solid preparations made by prolonged boiling of meat. Assumed to be of high nutritive value, but actually containing little besides the coloring and flavoring matters and mineral salts of the meat. When used hot are slightly stimulant; are moderately useful in tiding over conditions of collapse and depression.

Extra Current. If a current of electricity which is flowing through a spiral or coil of wire be suddenly broken, the self-induction of the different spires on one another produces an after-effect of high potential, called the extra current. The self-induction, and hence the extra current, may be prevented by winding the wire double and in such a way that the current passes through adjacent parts in opposite directions.

Extradition. Surrender by one government to another of a fugitive from justice; regulated by treaty or statute.

Extrados. Outer curve of the ring of a stone arch.

Extraordinary Ray. When a beam of light passes through a doubly refractory crystal, it is in general separated into two rays, one of which does not obey the usual law of sines.

Extra-uterine Pregnancy (GESTATION). When an ovum fails to enter the uterus and is fecundated in the Fallopian tube, in the ovary or cavity of the abdomen. The various stages occur and a perfect fœtus may be developed, though usually the process is interrupted by rupture of the membranes or detachment of the placenta. The mother's death is apt to result from hæmorrhage or peritonitis. In rare instances a living child has been carried for several months beyond the usual term of pregnancy, and successfully removed by operation.

Extravasation. Escape of blood from the vessels, or of any fluid of the body from its normal receptacle; the substance which has thus escaped.

Extreme and Mean Ratio. A line is divided into these when the greater segment is a mean proportional between the entire line and the less segment.

Extreme Unction. Sacrament of R. C. Ch. applied to fortify the soul against the temptations of death; used only in dangerous sickness, by applying consecrated oil. Similar rite exists in the Greek Church.

Exudation. Pouring out into the tissues of some fluid not normally there; also the fluid itself.

Exumbrella. See UMBRELLA.

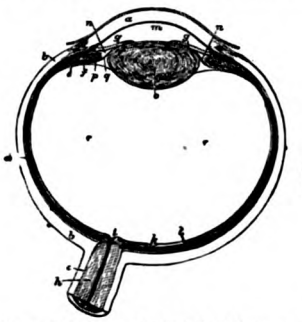
Exuviation. See ECDYSIS.

Eyck, HUBERT VAN, 1366–1426, and JAN, ab. 1370–1440. Flemish painters to whom the practical perfection of the art

Hubert and Jan Van Eyck.

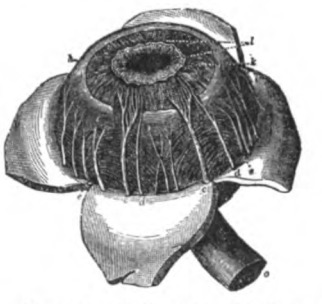
of oil painting is attributed. Their greatest work is the ADORATION OF THE LAMB (q.v.) in Ghent. Six narrow panels from this painting are in Berlin and two panels are in Brussels.

Eye. Organ of sight situated in orbit or socket, consisting externally of a fibrous structure, sclerotic, of a spheroidal shape, which occupies posterior $\frac{4}{5}$ of eye and of the transparent cornea in front. Between posterior surface of cornea and iris, or visible colored portion, is anterior chamber which communicates with posterior chamber, or space between iris and lens, by opening in center of iris, the pupil, both of which contain a thin watery fluid, aqueous humor. Behind the lens is the chamber containing the vitreous humor, of gelatinous consistency. Next to the sclerotic lies the choroid, a vascular structure with numerous dark pigment cells, and between it and the vitreous humor is the retina or expansion of the optic nerve



View of lower half of right Human Eye, divided horizontally:

a, cornea; *b*, sclerotic; *c*, sheath of optic nerve passing into sclerotic; *d*, choroid; *e*, ciliary muscle; *f*, ciliary process; *g*, *g*, iris; *h*, optic nerve with artery in center; *i*, passage of nerve into retina, called optic disk or papilla; *k*, fovea centralis; *l*, retina; *m*, anterior chamber of aqueous humor; *n*, posterior chamber of aqueous humor; *o*, crystalline lens; *p*, zonule of Zinn; *q*, suspensory ligament of lens; *r*, vitreous humor.



Choroid and Iris, exposed by turning aside the sclerotic:

c, *c*, ciliary nerves going to be distributed in iris; *d*, *d*, smaller ciliary nerves; *e*, *e*, veins known as vasa vorticosa; *h*, ciliary muscle; *k*, *l*, converging fibers of iris; *o*, optic nerve.

which pierces the sclerotic at the posterior part of the eye. Motion is communicated by several muscles duplicated on each side which contract synchronously. Front portion is covered by the conjunctiva which also lines eyelids, and at the upper outer side is the lachrymal gland which secretes the tears which pass into the lachrymal duct, which terminates in the nose, by two small openings, one in the upper and lower lids respectively, at the inner angle of the orbit. Eyelids project from above and below, over the eye; made up of skin on the outer side, mucous membrane on the inner, and a fibrous framework in the interior. On the edges are the lashes and within are a number of small glands. Conjunctivitis, keratitis, iritis, cataract, retinitis, choroiditis, and glaucoma are the principal and most common diseases; hypermetropia, myopia, and presbyopia are defects in vision due to abnormalities of shape, disease, or advanced age.

Eye and Ear Method. Method often employed in physi-

cal experiments in which observations are made simultaneously by both the eye and ear of the observer; *e.g.*, this method is employed in determining the time of oscillation of a pendulum by counting the number of ticks of a watch between two successive transits of the pendulum across the field of a telescope.

Eye-Bar. Rectangular bar, whose ends are enlarged in a circular shape and have holes through them in which pins can be placed. The largest now made are 10x3 inches, the material being steel. They are mainly used for the chords and bracing of bridge-trusses.

Eye-Bolt. Bolt having its head enlarged with a hole through it; into which a pin can be inserted.

E. officinalis; E. odontites.

Eyebright. *Euphrasia officinalis.* Small plant of the natural order *Scrophularineæ*, native of the colder parts of the n. hemisphere.

Eyepiece. Lens or lens combination in an optical instrument, as a telescope or a microscope, which is nearest the eye and magnifies the image formed by the objective.

Eyes OF INVERTEBRATES. May be monostichous or diplostichous, monomeniscous, or polymeniscous, retinulate or non-retinulate.

Eyestone. Small rounded concretion found in the stomach of European Craw-fish; consisting chiefly of carbonate and phosphate of lime; popularly supposed to assist in the removal of dust, etc., from the eye by attracting it, but in reality of no effect save in increasing the flow of tears.

Eye-Tooth. Fourth tooth on either side of the middle line of upper jaw.

Eylau. Town of Prussia, 23 m. s. of Konigsberg; scene of an indecisive battle between the French under Napoleon, and the Russians and Prussians, Feb. 8, 1807. Each side lost ab. 20,000 men.

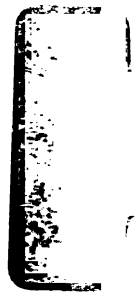
Eyre, EDWARD JOHN, b. 1815. Explorer of central Australia 1840–41; Gov. of Jamaica 1862–66; recalled for summary measures in suppressing a rebellion.

Eytelwein, JOHANN ALBERT, 1764–1848. Prussian civil engineer; Ober-Landes-Bau-Director 1816. *Grundlehren der höhern Analysis*, 1824; *Handbuch der Hydrostatik*, 1826.

Ezekiel. Jewish captive in Mesopotamia, prophesying ab. 594–572 B. C. His book is 26th in O. T.

Ezion-geber. Port on Elanitic Gulf of Red Sea, e. of the Sinaitic Peninsula, from which Solomon carried on a foreign commerce.

Ezra. Author of 15th O. T. book, describing the return of a Jewish colony from Babylon to Jerusalem, under his leadership, ab. 458 B.C.

Ezzelino di Romano. Ghibelline leader of 13th century, who powerfully supported the cause of Frederic II. against the Guelphs of Lombardy. Frederick bestowed on him the hand of his natural daughter Selvaggia.

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